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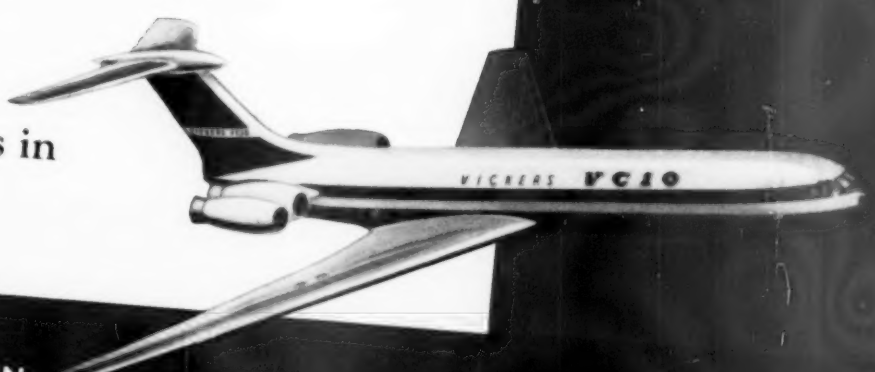

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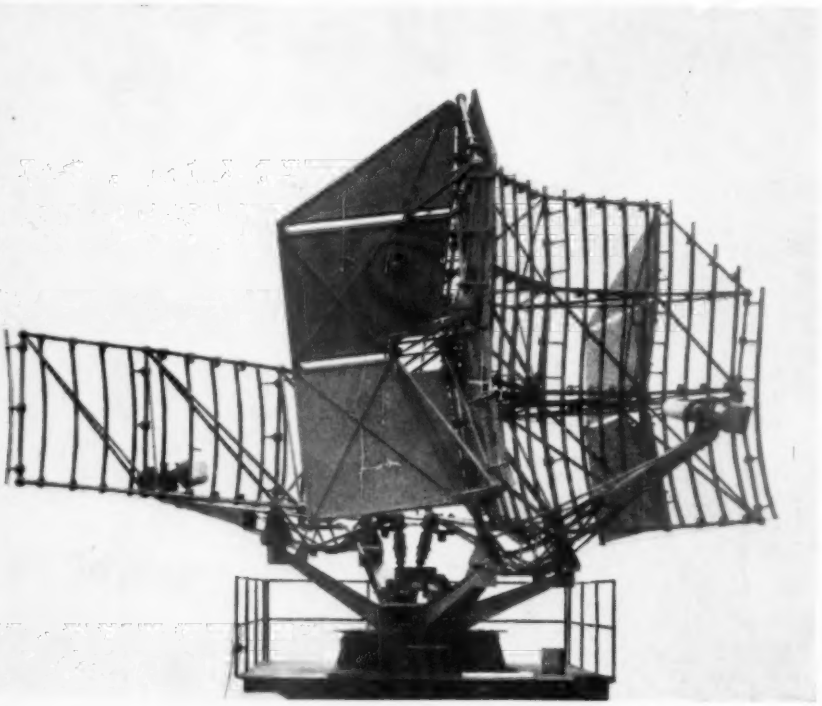

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CONTROLS
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. . . another great step forward in flight safety

Elliott experience in military aircraft controls . . . in inertial navigation . . . in digital computers . . . these may seem far removed from the control of a civil airliner. But, in fact, all the skills and experience of Britain's leading company in aircraft control have played their part in producing the highly advanced control system for the Vickers V.C.10.

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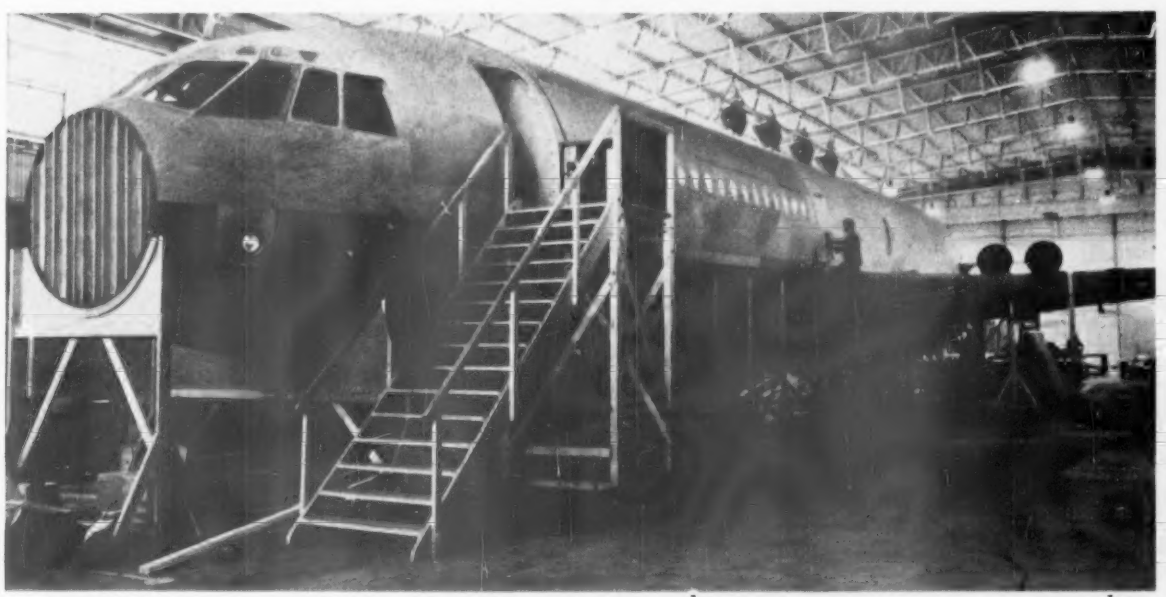
The Elliott control system in the V.C.10 represents a great contribution to flight safety—moreover, the system also provides, for the first time in any commercial aircraft, full provision for safe fully automatic landing.



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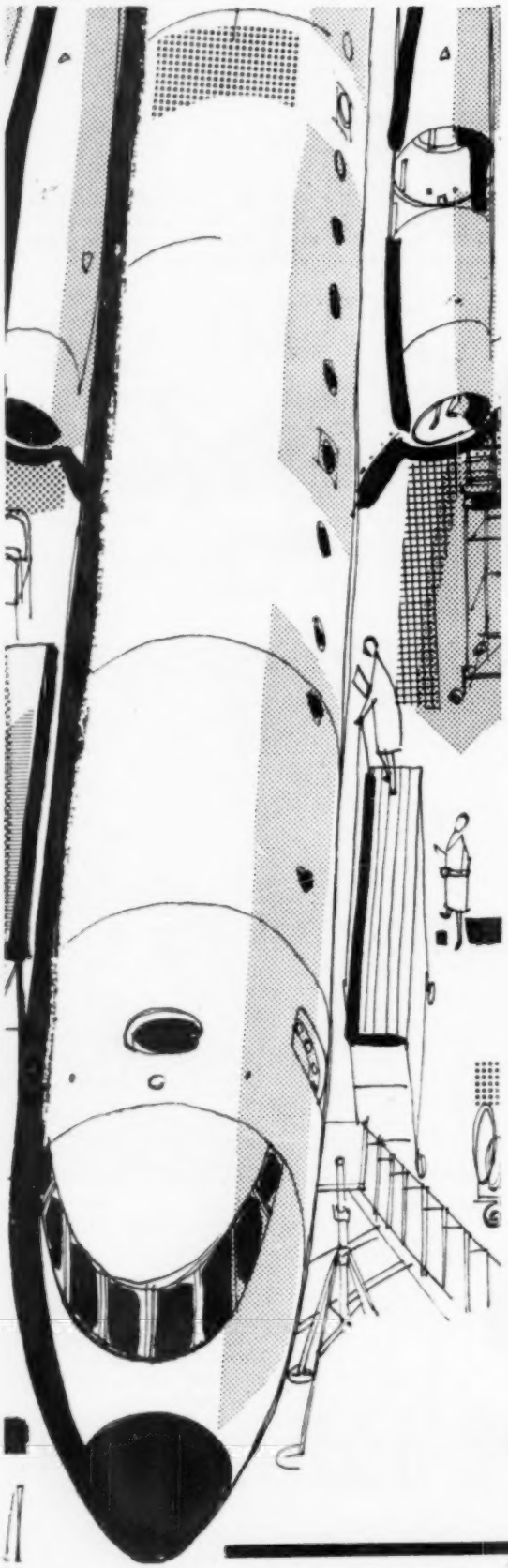

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and best wishes
for the future
to

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on their
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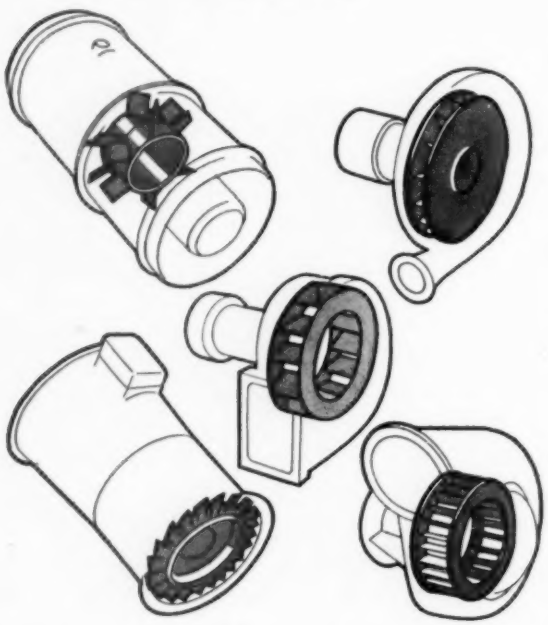
AIRSCREW *offer many congratulations to their friends and near-neighbours in Weybridge, whom they are proud to supply with fans for many famous Vickers aircraft.*



AIRSCREW, one of the oldest names in fan design and manufacture, offer a specialised service to aviation covering every type of lightweight axial and centrifugal fans. Cabin ventilation, windscreen de-icing and de-misting, cockpit cooling, oil cooling (helicopters), blast cooling for generators, radio and electronic cooling—AIRSCREW make fans for all these applications and can cater for every type of drive.

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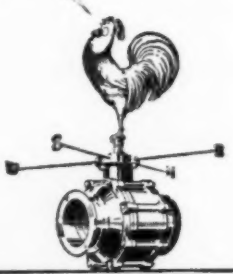

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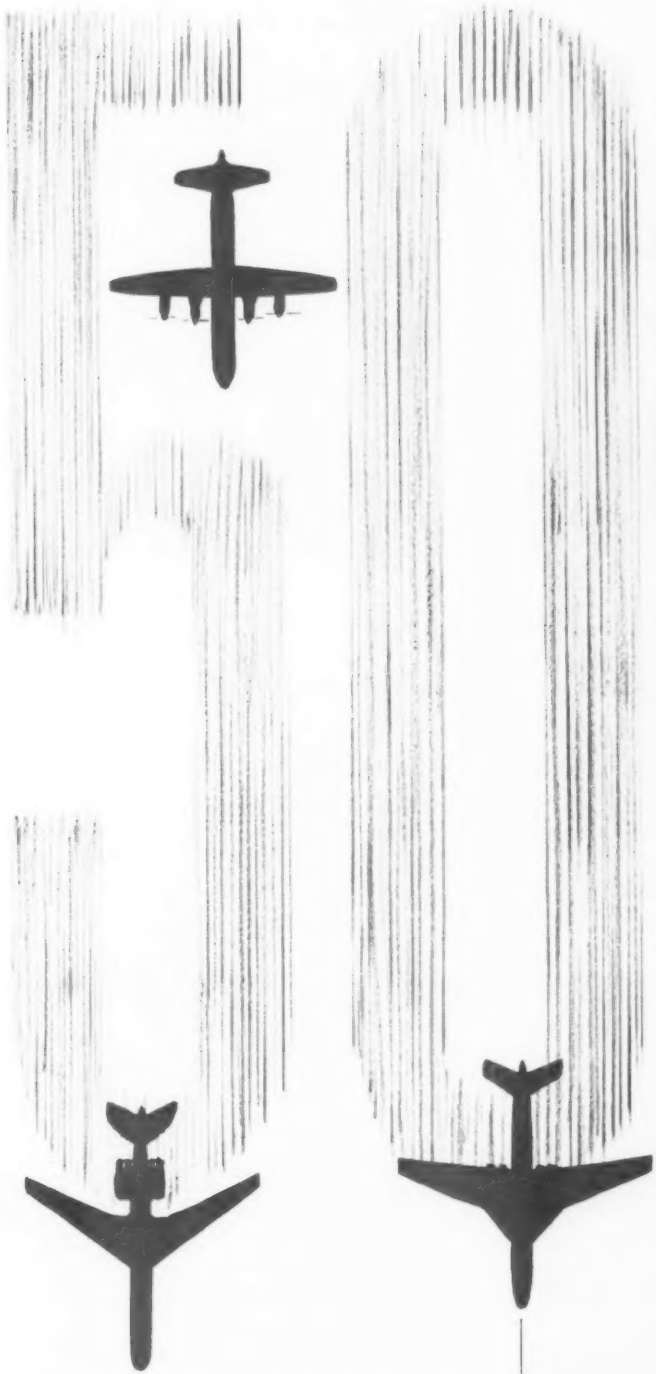

ON THE OCCASION OF

VICKERS

50th ANNIVERSARY IN THE FIELD OF WORLD AVIATION

ESC

joins the many Companies offering congratulations to this organisation which has been responsible for so many outstanding achievements.

Throughout this period ESC has been one of the world's leading producers of special steels and drop forgings made to the high standards of quality demanded by the aircraft industry.

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To VICKERS
now celebrating their Golden Jubilee
The Walter Kidde Company Limited,
leading specialists in the field of Aircraft Safety Equipment,
acknowledge with pride and gratitude their pioneering
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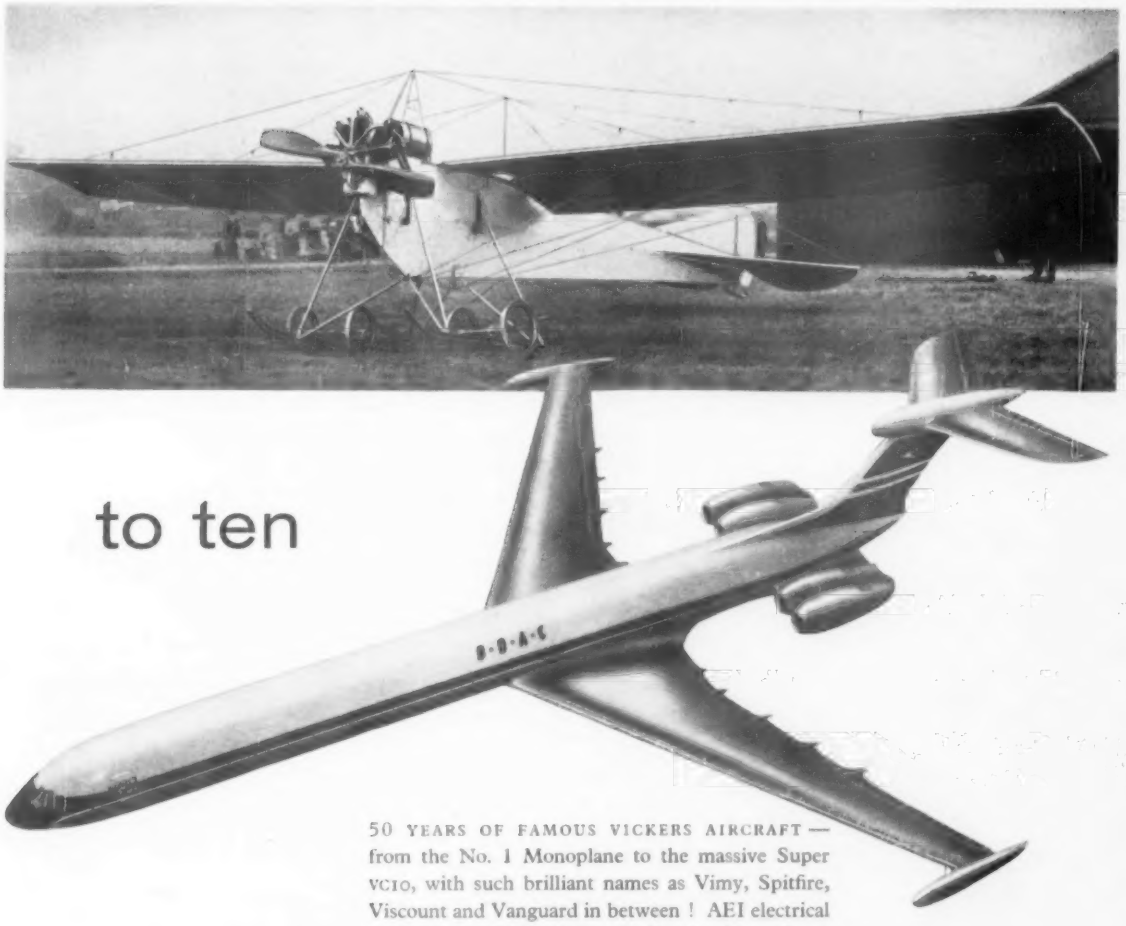
From one



to ten

50 YEARS OF FAMOUS VICKERS AIRCRAFT — from the No. 1 Monoplane to the massive Super VC10, with such brilliant names as Vimy, Spitfire, Viscount and Vanguard in between ! AEI electrical equipment will have been supplied for them all.

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SMITHS AVIATION DIVISION

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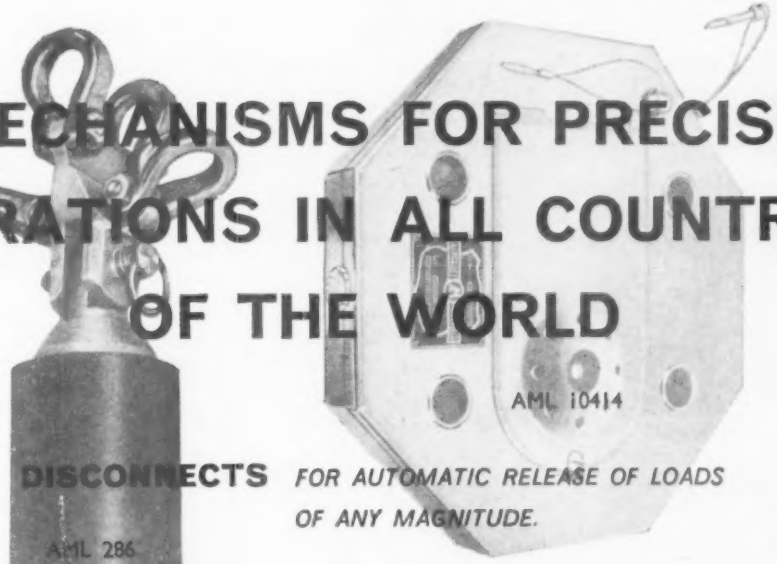

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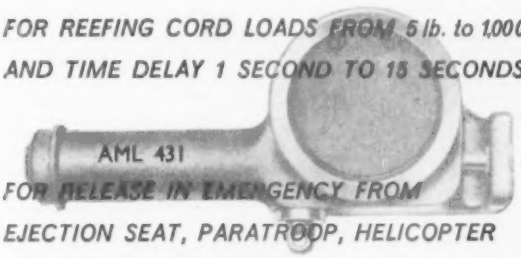

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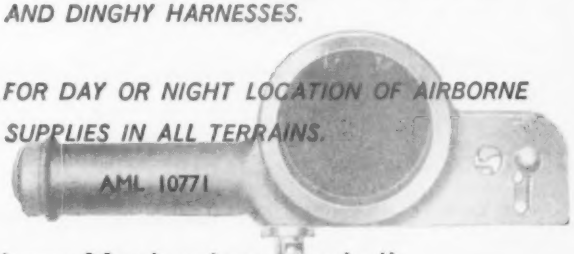

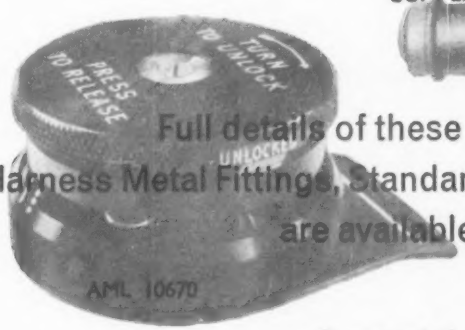

Full details of these Mechanisms and all Harness Metal Fittings, Standard Parts, Metals and 'Pop' Rivets are available on request.

Congratulations to Vickers on their 50 years of service to the aircraft industry. For 35 of these years we have played our part in the making of aircraft history.

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third major Vickers aircraft with
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FOR 25 OF THEIR 50 YEARS

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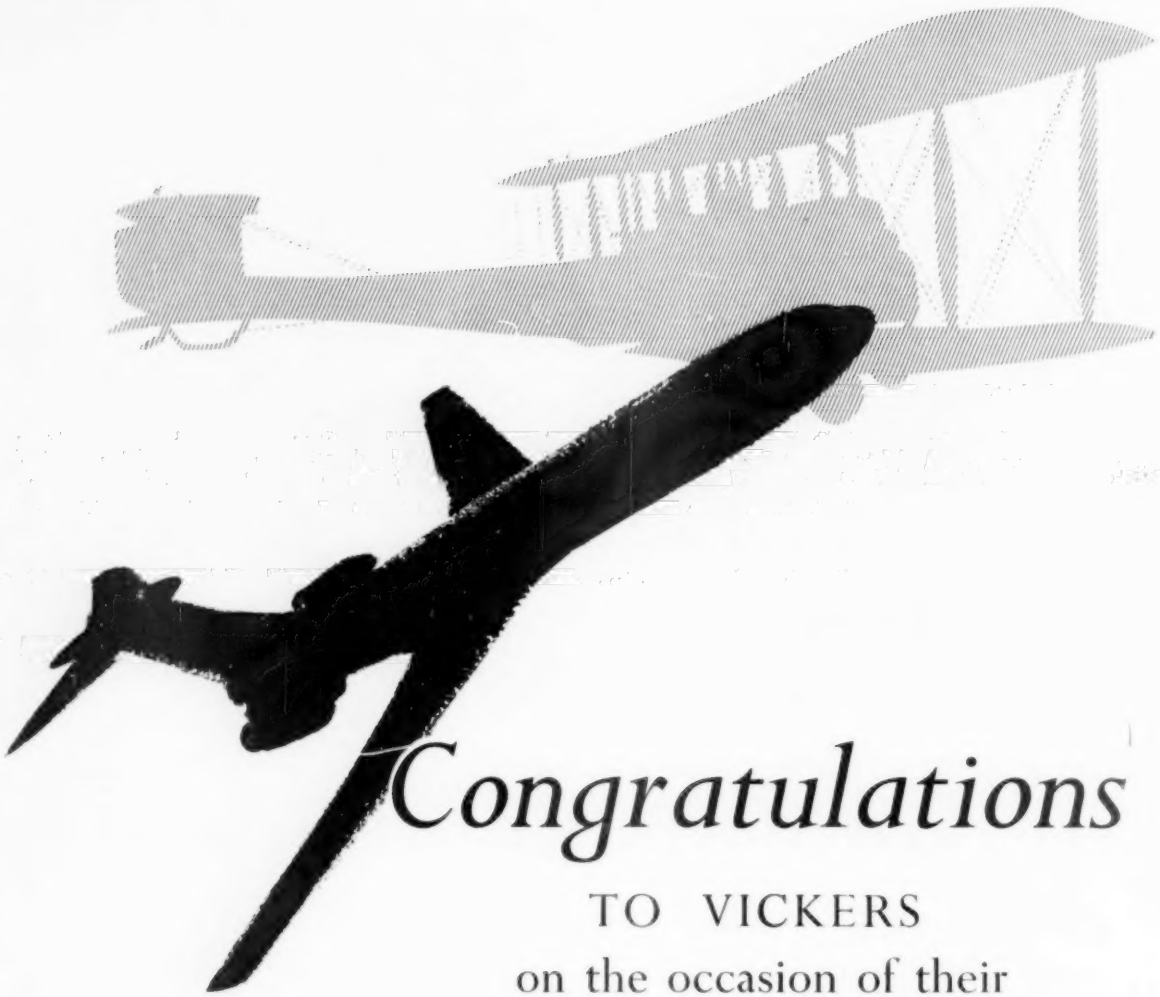

Congratulations

TO VICKERS

on the occasion of their

GOLDEN JUBILEE

As suppliers of equipment for many famous Vickers aircraft, including the Transatlantic Vimy and the new VC 10, H. M. HOBSON LTD., are proud to record the long and happy association which the two companies have enjoyed over the years.

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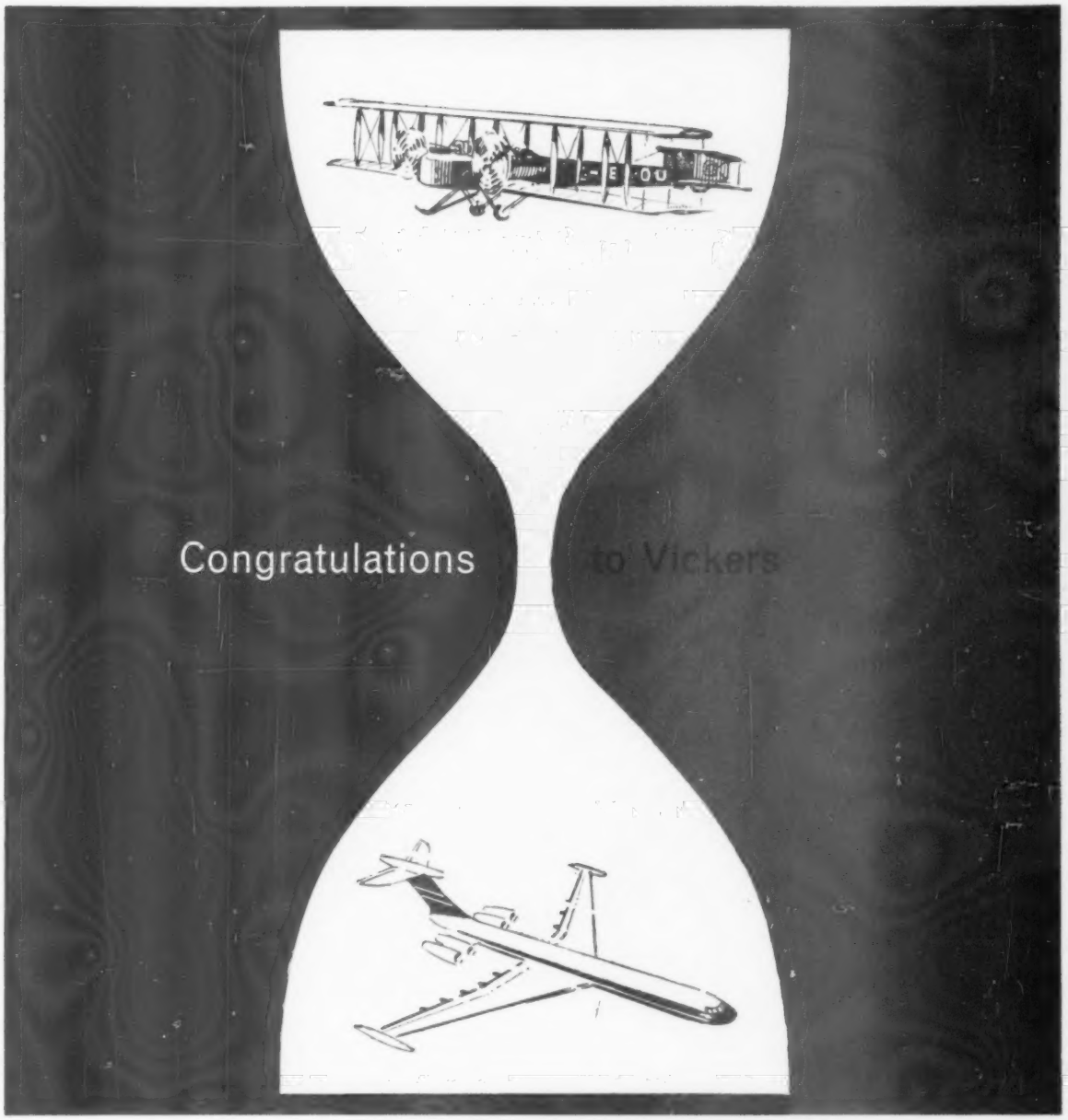

On the occasion of the Fiftieth Anniversary of Vickers' entry into the age of flying machines, The Plessey Company Limited offer their warm congratulations to Vickers-Armstrongs (Aircraft) Limited and look forward to their next half-century of progress.

Plessey, who have long contributed to the success of Vickers' aircraft . . . the Viking, the outstandingly successful Viscount, the Valiant, the Vanguard—soon the VC 10—will continue to offer the finest electrical systems and equipment for the world's aircraft.

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Plessey

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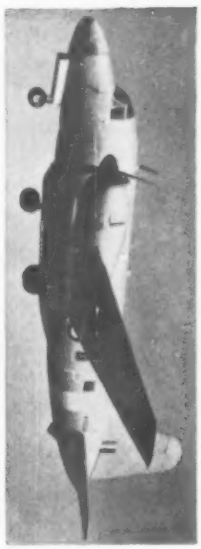
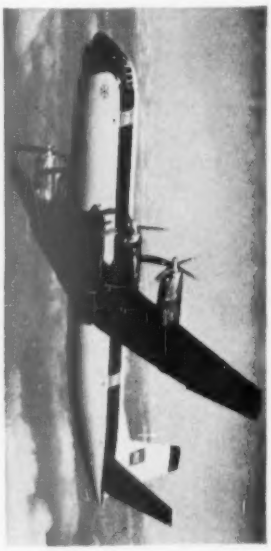

VARSITY

VISCOUNT

VALIANT


VANGUARD

THIS IS PROGRESS

The Viking of the immediate post-war period carried two dozen passengers; the magnificent Super VC10 is designed to carry over 200. Successive Vickers aircraft have made increasing use of CIBA (A.R.L.) products—of Redux metal-to-metal bonding for longer life under fatigue loading and of Aeroweb metal honeycomb for weight-saving sandwich structures. We send our congratulations and best wishes to Vickers on their fiftieth anniversary.

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AEROWEB honeycomb core

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C. F. TAYLOR GROUP

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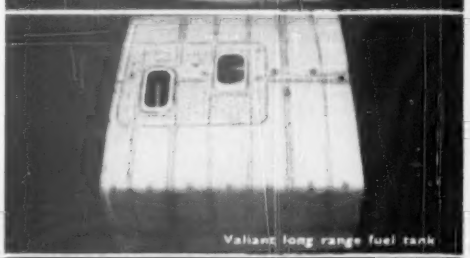
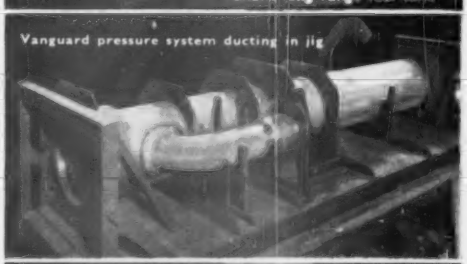
and congratulate them on their

GOLDEN JUBILEE

Viscount wing root nose fairing


Valiant long range fuel tank


Vanguard pressure system ducting in jig

Vanguard Glasscloth pressure ducting

Vickers V.C.10

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This is the Vickers Vimy in which Alcock and Brown made the first direct transatlantic flight in June, 1919. Their time was 16 hours 12 minutes. The aircraft was powered by two Rolls-Royce Eagle engines.

This is the shape of the future, the Vickers Super VC10. Ordered by B.O.A.C., the Super VC10 will fly at the beginning of 1964 and is intended for special high-density routes. It is powered by four Rolls-Royce Conway by-pass turbo jets.

These two pictures illustrate the years of successful co-operation between Vickers and Rolls-Royce. Both aircraft, one with a distinguished past, the other with an exciting future, are products of this partnership.

Between the Vimy of 1918 and the Super VC10, which will fly in 1964, have come many famous aircraft, designed and built by Vickers and powered by Rolls-Royce. They include the record-breaking Supermarine Schneider Trophy winner and the highly successful Viscount.

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THE AEROPLANE and ASTRONAUTICS

VOLUME 99 NUMBER 2567 DECEMBER 30, 1960

Slowly the Links Tighten

Last week's announcement by the Minister of Defence regarding the integration of Fighter Command with NATO is a visible sign of the growing political realization that in a World dominated by the military power of the air and shrunk by the distance-devouring capability of the aeroplane, the sharply defined borders of nations no longer have real significance. Larger groupings are necessary.

Not only is this true of military arms but of manufacture and trade. Hence, of course, the groupings of the European nations into the Six and the Seven. Hence also the fact of the Fairey Company in Belgium building American aeroplanes for the German Air Force. Again, we had news last week of an even more significant negotiation, the purchase of a French fighter for the Australian Air Force. The significance of that deal will achieve its maximum impact if, in due course, the aircraft are powered with Rolls-Royce engines.

Perhaps the best news is the agreement now in sight, to work out a combined Anglo-French effort, with a Blue Streak launcher and French second stage, to launch a communications satellite. A veritable *entente espaciale*.

Moving Around More Freely

In his Lanchester Memorial lecture before the Royal Aeronautical Society Professor A. D. Young brought out a point that we feel sure the great father of British aerodynamics would have supported warmly. This is the benefit to be obtained by arranging for a greater interchange of staff between universities, government research establishments and the aircraft industry. We should have been flattered had he added the aeronautical Press. In our experience, strength in technical journalism may be seen to spring most directly where staff have recent research or industrial experience.

The distinguished lecturer observed that staff interchanges seemed to be more difficult to arrange in Britain than in other countries. We suspect that this might be traced to what could be called "the little black book" philosophy. An American contemporary, *Control Engineering*, asks ironically:—

"Why not store your engineering know-how in a little black book and keep it to yourself? Why give away what appears to be an advantage? Your employer may take a similar stand, feeling that exclusive ownership of your 'special' knowledge gives him an edge over his competitors. . . .

"We wonder how people will know that you have a store of special knowledge and what will prompt them to beat a path to your door. How will you stimulate them to give you the benefit of their knowledge? . . .

"Over and over we have seen an engineer's mind open when he has tested his knowledge before his peers. He has found that others in his profession already had much of his 'exclusive' knowledge. Those who had progressed beyond him were willing to contribute ideas and information that expanded his mental view and amplified his fund of knowledge. His mind continually gathered more than his black book could contain."

Exchange of knowledge, we venture to suggest, is the beginning of wisdom.

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Matters of Moment

Unified European Air Defence

THERE has long been a requirement within NATO for a unified air defence system; its price, so far as the U.K. is concerned, is the transfer of Fighter Command to the control of SACEUR, General Lauris Norstad. This was made clear shortly before Christmas by MR. HAROLD WATKINSON, Minister of Defence, in a written Parliamentary reply to MR. F. A. BURDEN (Cons., Gillingham).

Under the new system, the U.K. will form one of the four NATO air defence regions, which are understood to comprise additionally Central Europe (Belgium, Holland, W. Germany and part of France), Northern Europe (Denmark, Norway) and S. Europe (Italy, Greece and Turkey). These would fit comfortably within the existing NATO organizations of Allied Air Forces Northern, Central and Southern Europe, which hitherto have comprised mainly tactical aviation units for the support of associated land forces.

Mr. Watkinson's statement added that the scheme provided safeguards to protect the national interests of the NATO nations taking part. National authorities would retain the right to decide the size, composition, rôle and deployment of their air defence forces assigned to SACEUR. It appears that Britain has not committed the entire resources of Fighter Command, now greatly depleted and estimated at about 30 squadrons, distributed fairly equally between Hunter day interceptors, Javelin all-weather interceptors and Bloodhound surface-to-air missiles. The Hunters are currently being replaced by Lightnings, which have already reached a couple of squadrons.

It is possible that there will be some redeployment of Fighter Command units, although their primary rôle of defence of the deterrent remains unchanged, and no movements could be made without British Government approval. The R.A.F. will still be able to deploy the Command's aircraft as required, including overseas, although the A.O.C., Air Marshal Sir Hector McGregor, would have an obligation to inform SACEUR of the proposed movements.

French indecision has been one of the delaying factors to unanimous approval of the new scheme, and even now it seems that France's Fighter Command—the *Défense Aérienne du Territoire*—is not yet committed to NATO. This may now happen, following the British example, but in the meantime the main responsibility for NATO defence in Central Europe rests on eight squadrons of Sabres and four of CF-100s from the R.C.A.F., F-102 interceptor units of the U.S.A.F., Hunter squadrons from the Belgian and Dutch air forces, and Sabre squadrons of the Luftwaffe. All these units, except for those of the U.S.A.F., are soon to re-equip with the F-104.

Less Money for Skybolt?

BRITISH development of a new strategic air-launched missile may be accelerated by the news that the Eisenhower administration has not included any funds for further development of the Skybolt ALBM in its budget recommendations for the 1962 fiscal year. Both the British Aircraft Corporation and the Hawker Siddeley Group have had discussions with the Ministry of Aviation about an "insurance" missile.

The B.A.C. project is reported to be an air-launched ramjet missile known as the Bat. It will fly to its target at low level and supersonic speed, and probably follow a zig-zag course to confuse the defences. The project has apparently been evolved by a Bristol Aircraft team.

A cut in Skybolt development funds is not yet definite; it is merely a proposal by the Eisenhower administration in its budget for the year beginning Jly. 1, 1961. The budget must be approved by Congress and will be subject to reappraisal by the new Kennedy administration. The argument for the Skybolt cut is apparently based on increasing the priority for B-70 development and on a gradual phase-out of the B-52.

Both Douglas and the U.S.A.F. deny that the target dates in the Skybolt programme will be affected. Douglas stated on Dec. 22: "To the best of our knowledge the Skybolt continues to be funded and will be carried as an item in the fiscal 1962 budget."

Although, in fact, the development of Skybolt may not be affected by the Eisenhower proposal, it does indicate a doubt in some U.S. circles about the importance of this ALBM. This move is clearly likely to influence British plans for an "insurance" missile. The British nuclear deterrent will be a very damp squib after 1965 if Skybolt falls by the wayside.

Blue Streak—but French Black Knight

SHOULD France agree to come in with Britain and continue the development of Blue Streak as a satellite launcher, the French rocket industry is to provide the second stage. MR. GEOFFREY RIPPON, Parliamentary Secretary, Ministry of Aviation, made this clear in reply to a debate on the subject of communication satellites introduced by MR. AIREY NEAVE (Cons., Abingdon) in the House of Commons on Dec. 21.

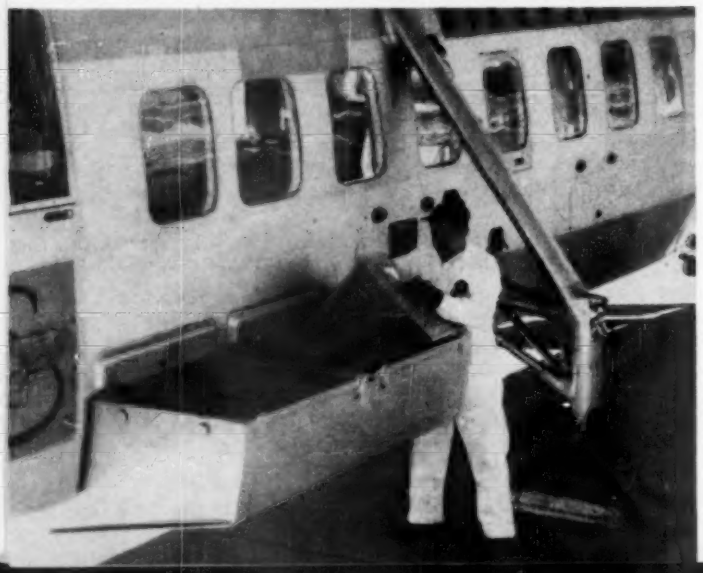
The case for the early development of British satellites of this type was ably presented from both sides of the House by members of the All-Party Parliamentary Committee on Space Research which has been sponsored by the British Interplanetary Society. Mr. Neave submitted that a British communication satellite was entirely feasible and could be wholly economic in terms of the Blue Streak launcher. MR. WOODROW WYATT (Lab., Bosworth) stressed that U.S. private industry was already getting into this field, and there was general agreement that it would be unrealistic for Britain to take up similar commercial development using American launching vehicles.

In reply, Mr. Rippon said there had been "preliminary talks with our friends in Canada and the United States, and the Postmaster-General is hopeful of being able to take part in very valuable tests. I hope that will be within the next year or so. We envisage putting two or three satellites into polar orbit."

Of the discussions with the French, these "had gone well." There was the possibility of developing a satellite launcher from our own Blue Streak and a second stage "based on French development work." Satellites could be launched by this combination "in the next five to six years."

The next step was to ascertain which other countries would wish to join in sponsoring the development of such a launcher. It was proposed to invite interested parties to join in a conference to be arranged early in the New Year. From this, Mr. Rippon concluded, would emerge a sufficient indication of interest in the project for firm decisions to be taken.

Thus, it seems that French participation in the Blue Streak project will rule out the use of Black Knight, or a modification of it, as the second stage. France is, of course, interested in



SIKORSKY DEBUT.—First flight of the Sikorsky S-61L was made on Dec. 6. Ordered by Chicago Helicopter Airways and Los Angeles Airways, it is expected to go into service in the autumn of 1961. The removable baggage "drawer" (left) can be loaded in the terminal building.

BELFAST MODEL.—Short Brothers and Harland have been given a contract for 10 strategic freighters for Transport Command. Hitherto known as the Britannic, this Tyne-powered aircraft in its R.A.F. version will be called the Belfast. A tactical version, the SC.5/20, with developed Tynes giving 9,500 b.h.p. each for take-off, is being projected.

developing an IRBM and conceivably this work could be married in some way to the Blue Streak booster, as the largest existing French rocket, the Veronique, has a somewhat lower performance than Black Knight.

The loss to British industry of the second stage of Blue Streak would be part of the price we must expect to pay in obtaining collaboration from abroad. Obviously, there must be concessions on both sides. We hope, nevertheless, that the British Government will take steps, should the combined operation go through, to embark on a "second generation" upper stage based on high-energy propellents (e.g., liquid hydrogen/liquid oxygen).

A Greek-Yugoslav Deal

IT has just been learned that Greece has sold to Yugoslavia some 50 jet-fighters to help bring the Y.A.F. up to date. This was the first Greek-Yugoslav agreement of this nature; it was concluded following approval from the U.S. State and Defense Departments. NATO was informed. Since the interruption of the M.D.A.P. to Yugoslavia, that country had faced serious difficulties in renewing its war material and in obtaining the necessary spares.

The 50-odd aircraft are Republic F-84Gs and they were sold for a sum of about $1,000,000—a "friendly" price which reflects the close ties between Greece and Yugoslavia. The F-84Gs have already been delivered to Yugoslavia; the last batch took off from Athens in August, piloted by Y.A.F. personnel. Yugoslav markings were painted on the jets in Greece before delivery.

Along with the aircraft which, thanks to the high-level maintenance by the R.H.A.F. ground crews, are in perfect operational condition, the necessary spare parts—including engines—which were selected by a special Yugoslav mission, are being sent by rail.

Informed diplomatic sources in Athens pointed out that this agreement was bound to strengthen even further the close ties and co-operation between Greece and Yugoslavia. They added that although the military alliance between Greece, Turkey and Yugoslavia had virtually ceased to exist, the regular exchange of military missions between the two neighbours (Greece and Yugoslavia) had enabled them to maintain a fair degree of understanding, which would not leave them unprepared in the event of aggression.

It is worth mentioning that the F-84Gs were almost withdrawn from active service and were issued to second-line fighter/bomber squadrons, based mainly in Crete. The aircraft sold will possibly soon be replaced by Italian Fiat G.91s; the present plans are for re-equipping two fighter/bomber squadrons with these aircraft, that proved more suitable to Greek needs and conditions.

The Greek Government issued a statement confirming this transaction, but did not disclose the exact number of aircraft sold or the value of the spares.—T.C.T-T.

New A.I.C. Chairman

AT the annual meeting of the Aluminium Industry Council in London on Dec. 16, Mr. H. G. Herrington, C.B.E., (managing director, High Duty Alloys, Ltd.) retired from the chair after having served for the maximum permitted period. A warm vote of thanks was extended by the members to Mr. Herrington for his services to the Aluminium Industry during his tenure of office.

Mr. S. E. Clotworthy, C.B.E. (managing director, Alcan Industries, Ltd.) was unanimously elected chairman of the Aluminium Industry Council for the year ending December, 1961.

"H. P." in Form

IT was good to see—and hear—Sir Frederick Handley Page back in his inimitable form at his company's annual senior staff dinner last week. In his characteristic and vigorous fashion he had some encouraging things to say about the future; and he roundly denied all rumours that consideration was being given to selling the Handley Page company to an American concern.

There had never, declared Sir Frederick, been any negotiations of any kind with any company in America to sell the British company. The rumours arose, he went on, out of a simple, laudable object—to get an American company to sell the Herald in the United States and, perhaps, for Handley Page to sell something of theirs over here in exchange.

Handley Pages, he asserted, had a great future ahead of it. It was essential for success that within an organization there should be goodwill between the constituent units, and this the company had.

Earlier, the guest of honour, Lord Douglas of Kirtleside, had brought back some nostalgic memories to many of the company's old-timers with some reminiscences of the days of Handley Page Transport, Ltd., and joy-riding at Cricklewood in 1919 in the O/400.

Of his host, Lord Douglas commented that he was a remarkable man who started his company 51 years ago and was still going strong. He spoke for everyone when he wished "H.P." "more power to his enterprising elbow."

In addition to the traditional Christmas fare, the evening was enlivened by the first "public" showing of some films made of the Herald's recent tours in Scotland, India and South America. And with a host in such good form it was impossible for any of the 35 members of the company's senior staff and their guests who were present, not to enjoy a most stimulating evening.—F.T.M.

The Importance of University Research

A CALL for a greater interchange of staff between the universities, Government research establishments and the aircraft industry was made by Prof. A. D. Young, M.A., F.R.Ae.S., A.F.I.A.S., of Queen Mary College, in his Lanchester Memorial Lecture to the Royal Aeronautical Society on Dec. 22. His subject was "British Universities and Aeronautical Research."

Prof. Young said that staff interchanges seemed to be much more difficult to arrange in Britain than in other countries. There was an excellent scheme whereby members of university staffs were encouraged to work for short periods at Government establishments as vacation consultants, but he would like to see these arrangements extended to cover longer periods and to be made reciprocal so that exchanges could take place for complete academic sessions or even longer.

Such reciprocal arrangements could well include staff from companies in the industry. Government scientists had on occasions been seconded to American universities for a year or so. This excellent idea would be very valuable if scientists could also be seconded to British universities.

In his paper, the lecturer traced the history of aeronautical work at British universities, described a typical present-day university department of aeronautical engineering and indicated the range of research done at British universities. On the subject of university departments, Prof. Young said that his received £4,500 p.a. to cover all its equipment needs, compared with less than £1,500 p.a. three or four years ago and about £20 before the War.

In general, equipment is as small, simple and cheap as modern research and demonstration needs will permit. Electronic

equipment, which is increasingly necessary, makes big demands on the annual budget, however; one good oscilloscope might cost £800.

Most British universities have some research contracts from the Ministry of Aviation; their total value is about £160,000 a year. These help to pay some of their junior research personnel and to buy special equipment. Such contracts represent a certain loss of independence, although the red tape involved has been cut to a minimum.

In future Prof. Young considers that there will be many fundamental problems in aeronautics which will be suitable for university research. For such problems a limitation of resources can be a stimulus rather than a hindrance, just as large and expensive equipment can sometimes dominate rather than serve the people responsible for it.

Soaring 34,000 ft.

THE World's single-seater gliding record for a gain-of-height, subject to confirmation, has been set up in New Zealand by S. H. Georgeson, known to his friends as Dick. Flying a Slingsby Skylark 3F from the Canterbury Gliding Club, which is within reach of standing waves in the lee of the Southern Alps, he gained 34,000 ft., beating the record height gain of 31,709 ft. set up in Germany by Karl Bauer, in 1959, in a thunderstorm.

Georgeson reached 35,200 ft. absolute altitude, which is short of the World record of 42,000 ft. set up by W. B. Ivans at Bishop, California, just 10 years ago; but Ivans' had to be towed to 12,000 ft. to contact his wave, whereas the New Zealand waves can be contacted even from a winch launch from the plain below. Georgeson previously reached 31,000 ft. in 1958. Philip Wills in the same New Zealand waves in 1954 set up the present British gain-of-height record of 28,200 ft.

The World's records for two-seaters, also set up at Bishop, are 44,255 ft. absolute altitude and 34,425 ft. gain-of-height.

Encouragement for Youngsters

IN a most stimulating talk to the apprentices of Hunting Aircraft at their annual prizegiving on Dec. 14, SIR GEORGE EDWARDS offered some heartening encouragement to any youngster who is starting, or considering, a career in aviation, which he described as a satisfying and exciting existence. Sir George was, however, careful to lay emphasis on the hard work and worry rather than the reverse. Even so there can be few among his audience who were not inspired by the picture he conjured up of dedication to a worthwhile and rewarding task. Real enthusiasm, these days, if not in short supply, at least is all too rarely expressed and it is good to hear a really authoritative enthusiast encouraging the younger generation in such terms.

Sir George commented that the real backbone of technical strength—which itself was the backbone of any engineering organization—was provided by a proper apprentice training scheme. And he was at pains to point out that, in this context, he was using the word "technical" in its broadest sense; a craft apprentice, he said, was just as much a part of the technical strength as a graduate engineer apprentice.

Earlier, Sir George had spoken warmly of the drive and energy of Sir Percy Hunting—shortly to retire—who had always associated himself very closely with apprentice affairs. The training scheme at Luton, he remarked, had the hallmark of Sir Percy's attention.

Speaking as the executive director (aircraft) of the British Aircraft Corporation and vice-chairman of Hunting Aircraft, now a member of the group, he made it clear that the Corporation would do nothing to upset the existing arrangement. From what he said, it is apparent that it is the intention of the B.A.C. to preserve as far as possible the identities of its individual components.

The last thing the Corporation wanted, he said, was to see loyalties, traditions and enthusiasm submerged. The plan was to harness these individualities together with the strength and breadth of the facilities now within the Corporation in such a way that it would really make an impact.

This integration, it appears, may well be felt among the trainees within the Corporation, for discussions have already been held between the education officers of the various companies with a view to planning an interchange of apprentices and students as a part of their courses. This would be an excellent arrangement, for it would mean that the youngsters would be given a much broader aeronautical education than would be possible in one factory alone.

Sir George said that he had every hope that all these plans would be achieved. Indeed, he was completely confident that the British Aircraft Corporation was "going to work" and would have a "thundering great order book."

On the subject of Britain's aircraft industry as a whole, he reiterated his belief that it had now got its "second wind." This had come with the formation of the new groups; with the Government prepared to help financially in civil projects; and with the revival of manned aircraft for military purposes.

As is customary on these occasions, MR. F. W. BUGLASS, the works director and chairman of the apprentices training committee, presided. In his opening remarks he warmly welcomed Sir George Edwards and had some nice things to say about the many guests and friends of the company who were present.

MR. H. G. HAMMOND, the company's education and training officer, in making his annual report was in the happy position of being able to record the Hunting apprentices' most successful year to date. Of 98 candidates for examinations, no less than 78% had passed.

Following this heartening report, the successful apprentices received their prizes and awards from MRS. RICHARD HUNTING. And the proceedings were brought to a close by a vote of thanks ably proposed by R. J. EAKINS, chairman of the apprentices association.

Principal prizewinners were: B. H. Orr (best all-round apprentice); D. Mead (best technical apprentice); W. Hunt (best practical apprentice); P. R. Ashill, B.Sc. (Hunting aviation scholarship 1960-62); R. A. Hewitt (Lawes Rabjohns Prize); and O. Joynes (Shakespeare Memorial Trophy).

The International Reference Work

ALTHOUGH *Jane's All The World's Aircraft 1960-61* can be described as "under entirely new management," at least in so far as editorial policy is concerned, the new volume shows no startling innovations. John Taylor, who succeeded Leonard Bridgman as editor a year ago, has quite properly devoted his energies to maintaining and improving the standard within the long-established format of Jane's. This he has done admirably.

There seems to be no shortage of new material for inclusion in this best-known of aviation reference works, despite industry mergers and dwindling military production. The year's edition devotes an all-time record of 413 pages to the aircraft section and has 45 more illustrations than last year for a total of 1,176, with a record 702 photographs used for the first time in this edition.

Pruning of the engine section has reduced this by six pages but the missile and airship sections are longer than before. A slightly more logical division between the aircraft and missile sections has been adopted, making them in fact "piloted" and "pilotless" respectively.

The editor has cast his net far and wide to gather in "all the World's aircraft," and has extended the policy of the past few years to include details of a multiplicity of "home-builts"—once they have proved their ability to fly. This necessarily lengthens the aircraft section, but is a policy which this reviewer fully endorses, if only because the title of the work itself presupposes the inclusion of these aircraft.

It was also inevitable, probably, that hovercraft and ground effect machines should be included, but in future years it may be necessary to reconsider this policy. Eventually, perhaps, we shall see a *Jane's All The World's Hovercraft*.

For the completeness, newness, and up-to-dateness of its contents, we unreservedly award Jane's 1960-61 full marks. But next year something should be done about the three-view line drawings, some of which are of a very poor standard.—F.G.S

A Leading Aerodynamicist

THE sudden death, on Dec. 9, of Prof. W. J. Duncan, C.B.E., D.Sc.(Eng.), M.I.Mech.E., F.R.Ae.S., F.R.S., Mechan Professor of Aeronautics and Fluid Mechanics at Glasgow University, has robbed aviation of one of its leading aerodynamicists and stability and control specialists. Prof. A. R. Collar, writing in *The Times*, said of him: "During his life, Duncan made significant contributions not only to flutter and to matrix analysis: he wrote extensively on stability and control of aircraft, on mechanical admittances, on dimensional theory and on fluid mechanics. In the latter field he was one of the pioneers of oscillatory aerodynamics."

Born in 1894, Prof. Duncan was educated at Dulwich College and University College, London. After seeing War service from 1915 to 1919, he spent seven years in marine engineering before becoming a member of the aerodynamics department at N.P.L. In 1934 he was appointed Wakefield Professor of Aeronautics and head of the department of aeronautics at Hull University which he remained until 1946—although during the War he was attached to R.A.E. After the War he became professor of aerodynamics at the College of Aeronautics, Cranfield—a post he held until 1950 when he went to Glasgow. He was chairman of the Aeronautical Research Council.

Kerosene—IATA Deplores Lord Brabazon's Stand

LORD BRABAZON has shown himself to be a vigorous crusader, determined that the airlines shall use the safest fuel available. He is convinced that so far as turbine-driven aircraft are concerned the safest fuel is kerosene. He has repeatedly made this point in speeches, as we have copiously reported, but he achieved his widest audience with his appearance in the television programme "Panorama" on Nov. 21, when he demonstrated the relative inflammabilities of kerosene and JP.4.

Following this, letters were exchanged between him and Sir William Hildred, director general of the International Air-Transport Association. These have been published *in extenso* in *The Listener* for Dec. 22. No doubt many who read this will have seen the letters for themselves, but for those who have not we publish them below.

The juxtaposition brings out the concision with which Lord Brabazon makes his point. Turbines run with equal safety on kerosene or JP.4. If they did not the A.R.B. would not have certified them as airworthy. Kerosene ignites much less readily than JP.4; in Lord Brabazon's graphic phrase, JP.4 flashes into a bonfire. In a minor crash fuel will be spilt. In such circumstances the use of a fuel that is reluctant to ignite is the best step that can be taken towards the passenger-carrying aircraft so long demanded by the late C. G. Grey, founder-editor of this paper, "that will land slowly and *not burn up*."

Lord Brabazon roundly states that the reason for using JP.4 in preference to kerosene is one of "money making." This is a serious charge in the general context.

Now these are the points which one might have thought the director general of IATA would have concerned himself with. As it appears the fact that there is no technical reason for the preference of JP.4 it is pertinent to expect an answer explaining why it is used. Perhaps there are operational reasons for its selection. It may be that at some airfields kerosene is not available. Well and good. Readers of the correspondence will wonder why Sir William did not make this point.

The cable from the technical committee would have carried more conviction if it had drawn on the undoubted (*pace* Lord Brabazon) technical abilities of the engineers who sit on it to elucidate the technical problems. For instance, it has been suggested that in certain conditions at altitude fuel tanks with kerosene in them may be more prone to ignition by electrical discharge than tanks with JP.4 in. Surely if there is experimental evidence to prove this, IATA's technical committee should give their views on its significance.

What does not seem proper is for the Technical Committee to draw up a cable containing a phrase that implies a threat to the British aircraft industry. Let it not be forgotten that the British industry was the first to produce aircraft which were able to demonstrate the increase of safety obtained by running on kerosene.

What we must regret, and we are sure that Sir William Hildred will, is the suggestion that eight million viewers on television are of the low stage of development that makes them not fit for serious discussion. It was Casca "in his sour fashion" who referred to the rabblement howling, clapping their chapped hands and throwing up their sweaty night caps. Whatever gear television viewers may wear on their heads for watching their favourite programme, we can be certain that it will not be the sweaty night caps of Shakespeare's Roman mob. Nor do viewers adopt such wear when they go abroad in their tens of thousands on their holidays by aircraft of the members of Sir William's association.

We are pleased to think that the outcome of this exchange of letters will be steadily increasing pressure for aeroplanes that land slowly and *do not burn up*. Bravo! Lord Brabazon.

The Correspondence in "The Listener".

Lord Brabazon to the Editor of *The Listener*.

Dear Sir,

Your television critic, Mr. Peter Pound, was good enough to draw attention (*The Listener*, Dec. 1) to the item about aviation fuel in "Panorama" (Nov. 21) in which I appeared. Your readers may be interested to see the correspondence I have had with the director general of the International Air Transport Association on this subject:—

Dec. 2, 1960.

My dear Brab,

When some months ago you expressed views about JP.4 at an A.R.B. lunch, I wrote to you limiting myself to a correction of the accident figures wrongly ascribed to you in the Press reports.

I now learn from *Flight* and other sources that the subject has been raised again, this time on television before eight million viewers. The incident has been, I find, brought up at a meeting of IATA's Technical Committee which is at present meeting in Rio and I have just received the following cable from the chairman:

> "I WISH TO INFORM YOU THAT AS A RESULT OF DISCUSSION AT TECHNICAL COMMITTEE MEETING IN RIO IT IS THEIR UNANIMOUS OPINION THAT RECENT PUBLIC STATEMENTS AND TELEVISION DEMONSTRATION IN THE U.K. ON JP.4 VERSUS KEROSENE ARE HARMFUL TO THE WORLDWIDE AIRLINE INDUSTRY AND MIGHT INDIRECTLY BE HANDICAP TO THE BRITISH AVIATION MANUFACTURERS STOP THE COMMITTEE FEELS MOST STRONGLY THAT GENERALIZED PUBLIC STATEMENTS ON SUCH COMPLICATED TECHNICAL MATTERS BY PERSONS HOLDING RESPONSIBLE POSITIONS IN AVIATION AND PARTICULARLY AIRWORTHINESS AUTHORITIES ARE WRONG IN PRINCIPLE AND CAN ONLY BE HARMFUL TO THE FORMULATION OF SOUND TECHNICAL DECISIONS BASED ON FACTUAL EVIDENCE STOP CHAIRMAN IATA TECHNICAL COMMITTEE."

This committee contains a score of the best technical operators in the international industry. The Annual Conference which they control brings together over 500 of the best minds from research establishments, government departments, fuel specialists, engine, airframe and accessory manufacturers, and fighting services. They are doing a serious and valuable job. I have no difficulty in placing before you their opinion with which I agree.

I am very good at minding my own business but supposing you were absolutely right in your views, is it good to ventilate those views before eight million "sweaty night caps?" What does is avail you? With your enormous prestige is it not better to hammer those views out with technical people rather than to make dangerous statements to the emotional millions.

And if you were wrong in your views, then have you not done a real disservice to the cause of aviation in general and perhaps to British aviation in particular. I am puzzled and disturbed to find that you have chosen such a forum.

WILLIAM P. HILDRED,
Director General.

Dec. 12, 1960.

My dear Hildred,

Always pleasant to have a letter from you, but the one I am about to answer is signed by you as Director General of IATA and it is to that individual I must address these somewhat harsh words.

Let us be perfectly clear about the subject. No one has disputed, least of all myself, that turbine engines can run satisfactorily and safely on kerosene or JP.4, otherwise the A.R.B. would not have certified them as airworthy.

The point is that speeds of take-off and landing have gone up and in the event of a minor crash fuel will be spilt.

What I have done is to show the somewhat axiomatic fact graphically that whereas kerosene takes time to ignite, JP.4 flashes into a bonfire. No conference of so-called experts gathered at Rio or anywhere else can dispute this. I cannot follow why the truth about the behaviour of the two fuels under the circumstances named should not be known and it is an example of your contempt for your passengers, upon whom you exist, and your desire to keep them in ignorance of something that affects them, that you should dub those that saw the B.B.C. television programme as "8 million sweaty night-caps."

The crux of the question was given away by Mr. Knut Hagrup at Copenhagen when he said: "The point is that if JP.4 tends to become cheaper (it isn't now, but it may become cheaper) then we must be ready for it."

Strange that there was no desire to use JP.4 when it was dearer. The same so-called experts existed before, but their superknowledge was never voiced!

It is patently clear that the desire to use JP.4 is based on money making. I freely admit it has always been a question as to how much you should pay for safety. In this case on the basis that truth and knowledge should be known, it may be passengers might be prepared to pay a surcharge for travelling by kerosene, but I cannot and will not subscribe to your views that everyone except those interested in running airlines, should be kept in ignorance of basic facts.

A word about the rather comic telegram from Rio. First of all, if the technical committee are unconvinced as to what happens to the respective fuels in the case of a minor crash I am quite prepared to repeat the experiment, but a study of the La Guardia accident to an Electra when 70 people walked out of an aeroplane using kerosene that crashed and caught fire, instead of being burned alive, will appeal to passengers, if not apparently to some operators.

Second of all I do not follow the rather sinister veiled threat to British aviation. Turbine engines are turbine engines wherever they are made, and most reputable operators all over the World use kerosene.

The question your "best minds" have to answer is, in what way has JP.4 suddenly become so safe, now it is cheaper than kerosene?

I will not disclose to you my real opinion of IATA, but you must bear in mind that it is an organization of the operators and for that very reason the decisions they take are for their own advantage. There are other points of view and the time has come when they will be aired even if it is disagreeable to the Association.

It is indeed a strange situation I find myself in to be accused of doing harm to aviation by endeavouring to make it safer.

As it was the B.B.C. who inspired the demonstration I am sending this correspondence to them, as it will interest them.

Yours sincerely,

BRABAZON OF TARA.

Aviation News in General

MORE GERMAN F-104s.—The West German Air Force has ordered 30 additional F-104G Starfighters direct from Lockheed, bringing their total procurement figure to over 700. These 30 fighters, which are scheduled for delivery next year to form the nucleus of the first German operational squadrons, are in addition to the 96 American-built Starfighters already ordered.

R.A.N. EVALUATION.—Lieut. Cdr. C. M. Wheatley, R.A.N., is at present in the United Kingdom to evaluate the Westland Gnome Whirlwind on behalf of the Royal Australian Navy. He is the first overseas pilot to fly solo in this helicopter.

F-105D DEPLOYMENT.—Sixty-eight F-105D mobile maintenance training units were recently airlifted from Republic Aviation to Bitburg A.F.B., Germany. The shipment was part of the build-up of materials in preparation for the deployment of F-105D Thunderchiefs next year with U.S.A.F.E.

S.A.F.I. IN A CONVAIR.—The F.A.A. has completed installation of the first Semi-Automatic Flight Inspection equipment (S.A.F.I.) in a Convair 440. Developed by the F.A.A. and the A.I.L. Division of Cutler-Hammer, Inc., S.A.F.I. receives signals from VOR, DME and VORTAC stations on 26 separate receivers, and records them on tape for subsequent analysis on an IBM 704 computer. Five Convair 440s so equipped, will cover the whole of the U.S. in four months, each flight being programmed on the IBM 704 and navigated automatically from the tape.

TURBOPROP CARIBOU.—A de Havilland Caribou experimentally powered by two General Electric T-64 turboprop engines is expected to fly next May.

FAIRCHILD F-27s.—With four completed F-27 Friendships unsold and another six in various stages of final assembly, Fairchild has stopped work on this type, and will resume production only if these 10 aircraft are sold and further orders are obtained.

GOOD BUSINESS.—Keegan Aviation, of Panshanger aerodrome (Tel. Essendon 491), tell us that they have already parted with two of the four DC-4 civil transports which they recently advertised for "sale, lease, or part exchange." One was leased to World Wide Aviation and the other sold to Belgian International Air Services of Antwerp.

COVENTRY A.T.C.—Ekco VHF/DF equipment has been installed at Coventry Airport as part of the plan to expand the airport's facilities for handling increased air traffic.

SINGAPORE AIR SHOW.—A 9-day international air show will open on Apr. 8 at Singapore Airport. The first to be held on the island, it will include both static and flying displays and is designed to reach the increasingly air-minded Asian countries.

PARIS SCHEDULE.—The following arrangements have been announced for the 24th International Air Show in Paris next year: May 25, Press preview; May 26, inauguration; May 27, spaceflight; May 28, commercial aviation; May 29, aeronautical medicine; May 30, electronics; May 31, rotorcraft; Jne. 1, light aviation; Jne. 2, visits by foreign missions; Jne. 3, international flight demonstration; Jne. 4, international air show.

GNOMES FOR EXPORT

THE de Havilland Engine Company announced last week that it had sold Gnome turbine engines to the Agusta Company of Milan—to the tune of nearly £1 million. The engines are intended for the Bell 204 B 10-seat general-purpose helicopter which Agusta is to produce in quantity in Italy. According to the de Havilland announcement, this large export order was negotiated "in the face of stiff competition from American and European engine manufacturers."

A B.E.A. BRITANNIA.—To help with the Christmas rush, B.E.A. chartered a Britannia from B.O.A.C. and also brought some of its remaining Pionairs down from Scotland, in addition to using two Vanguards as noted in our previous issue. On Christmas Day itself, however, only two B.E.A. aircraft were scheduled to be in the air—a Comet from Athens and Rome and a Viscount to Cyprus.

A.T.C. LICENCES.—As from Aug. 15, 1962, control officers will be required to hold an Air Traffic Controller's Licence with four ratings—covering aerodrome, approach and radar-approach control. The current Aerodrome Controller's Certificate of Competency will not now be issued, but existing ones will be renewed until August, 1961.

M.E.A. EXPANSION.—The first M.E.A. Comet 4C flew to Beirut from Hatfield on Dec. 19 in 4 hr. 54 min. nonstop. The distance is 1,908 naut. miles. M.E.A. is expanding its sales organization in Britain to mount a nation-wide campaign in connection with the Comet services next spring. A new sales office has been opened at Piccadilly House, Jermyn Street, and sales staff have been appointed in Glasgow, Manchester and Birmingham.

Tu-114 INTO SERVICE.—Scheduled services by the Tupolev Tu-114 turboprop transport will begin in January, according to Tass. Non-stop service will be provided on the 4,350-mile route from Moscow to Kharbarovsk.

NIGERIAN SERVICE.—Speaking at the opening of a new terminal building at Kaduna, Northern Nigeria, the Federal Minister of Transport and Aviation said he had decided to license an independent operator to fly scheduled services with light aircraft in the Northern Region. The services, which Nigeria Airways could not operate economically with DC-3s, would link Kano and Kaduna with a number of smaller towns in the region.

PHILIPPINE ACCIDENT.—Philippine Airlines suffered its second major accident in less than a month on Dec. 21, when a DC-3 crashed on take-off from Cebu City and burnt. At least 28 of the 37 occupants are reported to have died.

PROJECT SAINT.—The Radio Corporation of America has been chosen by the U.S.A.F. to develop the final stage of the Saint satellite and rendezvous system. Vehicle will embody homing radar and a TV camera for the purpose of identifying "unknown" satellites on coincident orbits. Booster will be the Atlas-Agena B.

SPACE ROUBLES.—Russia is to reduce her arms expenditure by about £140 million in next year's budget, but will spend more than £1,500 million on science and space research, an increase of 15.7%.

ANOTHER DISCOVERER.—Discoverer XIX was successfully placed in a polar orbit by a Thor-Agena B two-stage rocket on Dec. 20. It carried instruments for detecting infra-red radiation from the Earth.

JAGUAR.—The three-stage Jaguar rocket reported in our issue last week was produced jointly by the Australian Department of Supply and R.A.E. Farnborough. First stage was developed in England and the second and third in Australia. Vehicle has an overall length of about 40 ft.

MERCURIAL.—A one-ton instrumented Mercury space capsule was successfully launched from Cape Canaveral on Dec. 19 on the nose of an 83-ft. 62-ton Chrysler Redstone. Capsule ascended some 135 miles and was deposited in the sea 235 miles downrange. It was equipped with a 16-mm. camera for monitoring instrument readings. Flight lasted some 16 min. and the maximum speed reached was 4,200 m.p.h.

TSR2 CONTRACT.—In his annual chairman's report to the shareholders of Sir George Godfrey and Partners, Mr. W. D. L. Theed disclosed that the company's aviation division had received a contract "to air condition and pressurize the TSR2 aircraft."

POSTPONED LECTURE.—The lecture, "Planning of Missile Acceptance Trials," by Messrs. Mercer and Cawthorne, due to be given at a meeting of the R.Ae.S. Astronautics and Guided Flight Section at No. 4 Hamilton Place, W.1, on Jan. 3, has been postponed. Instead a film show has been arranged, including the following: "Black Knight, the R.A.E. Ballistic Rocket Test Vehicle"; "Blue Streak" and "Communication Satellites." The programme begins at 18.00 hrs.

P. R. APPOINTMENT.—Mr. F. C. Gillman, B.O.A.C. chief Press and information officer, has been made president-elect of the Institute of Public Relations, and will take office in 1962. He has been chairman of the Institute's Council for the past year.

B.E.A. BOARD.—Sir Walter Edmenson, C.B.E., D.L., has been appointed to the Board of B.E.A. for a further period of two years from Dec. 16.

AMERICAS P.R.—Mr. Gilbert Carter, formerly air correspondent of the *Daily Herald*, has been appointed B.O.A.C. public relations officer, Americas. He succeeds G. A. "Gerry" Wynne, who died recently.

Air Transport

Secondary Radar Agreement

FOLLOWING their recent discussions in Washington, the Ministry of Aviation and the Federal Aviation Agency have now reached full agreement regarding the final technical characteristics of a revised ICAO requirement for secondary radar. Each authority is expected to issue its own national specification for what is in effect a slightly different, but compatible, system within the next few weeks and modifications to existing equipment are to be made retrospectively.

At the time of the 1957 ICAO agreement on secondary radar sponsored by the U.K. and the United States, the technical standard regarding such an international civil A.T.C. aid was agreed except for a small area, approximately 5%, dealing with side lobe suppression. In a secondary radar system a ground interrogator-responser generates interrogation signals which are received and replied to by a transponder-equipped aircraft in coded form for display on an A.T.C. PPI presentation and it is possible for the unsuppressed side lobes as well as the main lobes of the system to interrogate the aircraft so that several responses of this one aircraft appear on the primary radar display.

The U.K. method of overcoming this problem is by the use of a two-pulse interrogator-responser system, while the F.A.A. favours a three-pulse system, and the new technical agreement covers the design of an airborne transponder capable of replying to either two- or three-pulse side lobe suppression.

The F.A.A. originally rejected a three-pulse system suggested by the U.K. and it is thought that its new desire for this method of side lobe suppression follows the recent decision by the U.S.A.F. for such a system. This is more readily usable with present military IFF equipment.

Modification of existing British two-pulse airborne transponders to the new ICAO requirement, such as the Cossor Type SSR. 1251 installed in the B.O.A.C. 707 fleet, involves a certain amount of new circuitry and will add approximately 20% to the cost of the equipment. No changes to the aircraft's secondary radar control unit or aerial are necessary and the modification will not add to the weight of the equipment.

The Value of Flight Recorders

RECOVERY of the flight recorder from the Douglas DC-8 involved in the air-to-air collision over New York once again underlines the importance of this piece of equipment. If it is undamaged, it will already have provided vital evidence on the time of the collision and the altitude and heading of the DC-8 at that time. A reconstruction of the entire flight from the tape record should give a fairly accurate indication of the point of the collision, which may not have been easy to confirm from other evidence.

The C.A.A., and more recently the F.A.A., has for long been aware of the value of flight recorders and it is interesting to record that a Civil Air Regulation requiring the installation of an elementary type of recorder was issued as long ago as April, 1941. In the event, lack of equipment and wartime conditions prevented the implementation of this regulation, which would have covered only aircraft altitude and radio transmitter operation. A new regulation, in September, 1947, required automatic recording of altitude and vertical acceleration, but this also had to be rescinded (in July, 1948) for lack of suitable equipment.

Prolonged discussion between the C.A.A. and C.A.B., the airlines and the manufacturers followed, and a new regulation eventually became effective in July, 1958, requiring all aircraft of more than 12,500 lb. weight and operating air-carrier service above 25,000 ft. to carry recorders which would cover airspeed, altitude, direction, vertical acceleration (gusts) and time. These recorders are operated from take-off to landing and the records are kept for 60 days.

A further regulation has now been made, and will become effective by May 1, 1961, requiring all turbine-powered aircraft of over 12,500 lb. to carry recorders regardless of operating height. The addition of many other parameters to the flight record has now been found possible and the F.A.A. is studying closely this aspect of the requirement. Action is expected soon to require a record of cockpit conversations, to be kept on tape probably for only 15 minutes. Tower-aircraft conversations are recorded on the ground.

Although recorders are available and it is open to any manufacturer or airline to fit them, Britain has lagged in making their installation mandatory. The present situation was summarized in the House of Commons on Dec. 12 when Mr. G. Rippon, Parliamentary Secretary to the Ministry of Aviation, said, in a written answer, that "The Ministry of Aviation proposes shortly to issue tenders for the development of equipment to record and preserve essential data in the event of an aircraft accident. The specification has been drawn up in consultation with the A.R.B. and civil users and should be suitable for both civil and military aircraft."

Repairing the S.A.A. Boeing

DAMAGE to the South African Airways Boeing 707 which belly-landed at Nairobi on Oct. 30 is estimated at between £300,000 and £400,000. Spares including an engine, nose-wheel unit and instruments are being flown to South Africa, writes a correspondent, and with additional spares already held by S.A.A. these will be used to effect a temporary repair. The aircraft will then be flown back to Seattle—probably early in January—for a complete overhaul and repair ready for a return to service in April or May. At the same time, the up-rated JT4A-11 engines will be installed.

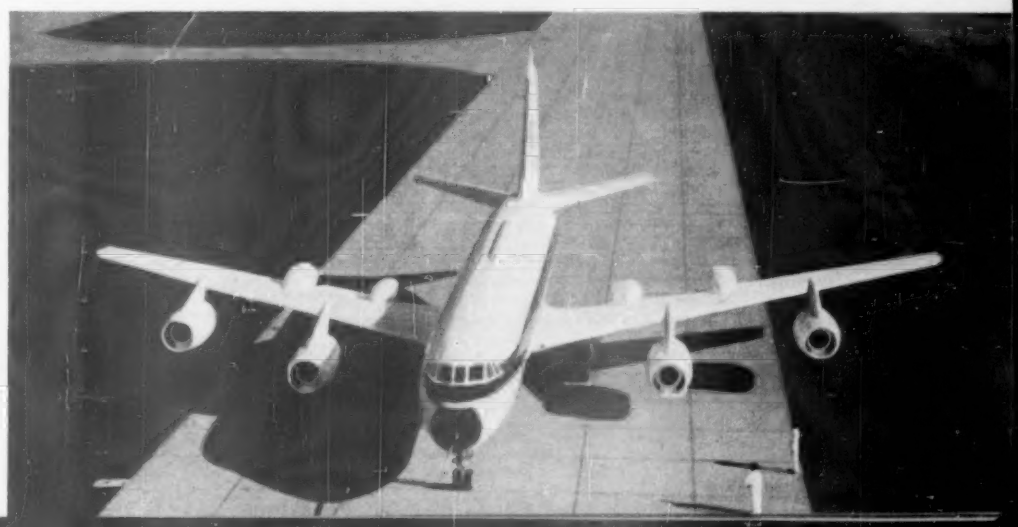
Meanwhile, the Johannesburg-London service is being maintained by the second S.A.A. Boeing. The third, which has full-span leading-edge flaps and JT4A-11 engines, is expected to be delivered in January.

Lufthansa Annual Report

THE year 1959 was one of expansion and consolidation for Lufthansa, whose annual report for this, their fourth year of full operation, has now been published. Despite having no jets—only the Super Constellations and Starliners for their long hauls—the airline succeeded in raising their average load-factors by 1% over the previous year. Very heavy write-down costs, however, attributable to the changeover to jet aircraft, have proved a heavy burden, and a loss of 38.8 million DM (including special write-offs) was reported.

Rising costs and the need for heavy investment have led to the proposal for an Air Union (between Air France, Alitalia, Sabena and Lufthansa). Though the final form is still being negotiated, the partners have agreed, says the report, on the following division of revenues: Air France, 34%; Lufthansa, 30%; Alitalia, 26%; and Sabena, 10%; this position to be reached within 10 years.

Great efforts were made in 1959 to increase coverage on existing routes, and Lufthansa see great opportunities for business in developing countries and former colonies. Capacity on the European network was increased by 53% with the delivery of seven Viscounts early in the year, and good



NINE-NINETY.—Large diameter intakes associated with the General Electric CJ-805-23 turbofans are a distinctive feature of the Convair 990, which is also identifiable by the "speed capsules" on the wing. The first 990 is expected to fly in the next week or two.

Air Transport . . . .

utilization was achieved on the London, Paris and Rome runs, but a poor response on the Scandinavian, Geneva-Nice and Spanish routes.

Despite jet competition, Lufthansa were successful on the North Atlantic route, and even increased their share of the traffic by a tiny amount. In Economy Class the passenger load factor was 72%. The Constellations were also making three successful flights a week to South America, until the Brazilian Government obliged the airline to reduce this to two. At the end of the year under review the overall load factor was the highest of any airline on the South Atlantic run.

Rather less successful were the ventures in the Near East, where increased capacity offered by Viscounts was not taken up. It was realized that only jet aircraft would make an impression here, and four Boeing 720Bs (later increased to eight) have been ordered for operations to the Near, Middle and Far East. On Nov. 1, 1959, the Cairo route was extended to Thailand, and plans are in hand to extend this still farther to Hong Kong and Tokyo with the coming into service of the 720s.

A satisfactory increase in freight traffic (36% over the previous year) is reported and, so far as international traffic is concerned, is attributed to the very speedy handling at German airports.

Owing to the pressing need to supplement the fleet with jets, Lufthansa were obliged to write down the value of their Starliners and associated engines and spares by 10 million DM, to bring them into line with the Super Constellations, Viscounts and Convairs, which are being written down to 10% book value in seven years. The intention is to write down the piston-engined machines to 10% book value at a greater rate in the next year or two, and use them as freighters and for charter work.

Howard Hughes Steps Down

EFFECTIVE control of Trans-World Airlines has passed out of Mr. Howard Hughes' hands for the next 10 years, as a result of the agreement concluded on Dec. 8 with a group of banks and insurance companies (see our Dec. 16 issue). As a condition of lending T.W.A. $165 million, this group insisted that the Hughes Tool Co. should place its 78% of T.W.A. stock in a 10-year voting trusteeship of three members. The vice-president of Hughes Tool, Mr. Raymond M. Holiday, will be one member of this trust, the other two being nominated by the senior lenders.

Of the $165m., $90m. will be provided by Equitable Life Assurance Society and Metropolitan Life Insurance Co., with the remainder contributed by a group of nine banks headed by Irving Trust Co. When the scheme was first proposed last March, the sum involved was $168m.; the reduction of $3m. is attributed to depreciation of the T.W.A. fleet of Boeing 707s in the meantime.

In addition to the $165m. loan, T.W.A. will offer $100m. debentures to its stockholders, and Hughes Tool has agreed to purchase its pro rata share (i.e., $78m.-worth) plus any not purchased by the other stockholders. With the money thus raised from these two sources, T.W.A. will complete the purchase of 19 Convair 880s to make a total fleet of 20; one 880 was delivered to T.W.A. last May for crew training and is wholly owned by the airline. T.W.A. will also now complete the purchase of its 707 fleet; at present, the airline owns two 707-131s and eight 707-331s, and leases from Hughes Tool another 13 707-131s and four 707-331s. All 27 Boeings were originally purchased by Hughes—which in the past has made T.W.A.'s equipment decisions—through short-term bank loans which have subsequently put a heavy strain on the company.

In all these dealings, incidentally, the Hughes Aircraft Co. has played no part. This latter company, which makes the Falcon missile, fire-control radar and other electronic equipment, earns about $12m. a year but has been of little value to Hughes in his airline financing deals since its shares were placed in the Howard Hughes Medical Institute, a charitable organization.

Other consequences of the agreement are likely to be the early appointment of a president by the T.W.A. board to succeed Mr. Charles S. Thomas, who resigned in July; appointment to the board of additional directors nominated by the lending groups; and completion of the plans for a merger between T.W.A. and Northeast (which is controlled by Atlas Corp., in which Howard Hughes has a 10% interest). This merger was first proposed last May, and was approved by the Northeast board. Action could not be taken by T.W.A. until its financing difficulties were resolved.

Hughes' original contract with General Dynamics was for 30 Convair 880s, of which, as we noted last week, six have been released from contract for use by Northeast. These aircraft have been placed by General Dynamics in the hands of a leasing corporation, which will raise loans to pay General Dynamics, and repay the loans, plus interest, from the lease payments made by Northeast. The engines are being leased from General Electric. As T.W.A. is now to take only 20 Convair 880s, four of the original contract remain uncommitted, but whether these are owned by the makers or by Hughes is not clear.

The Future for Transport Helicopters

AS part of its "Project Hummingbird" investigation into steep-gradient (V/STOL) aircraft, the Federal Aviation Agency last month issued a report* on the likely uses of the helicopter and other vertical take-off and landing aircraft in short-haul commercial air transportation in the next decade. The report is concerned only with U.S. domestic operations, and is based largely on the experience to date of the three U.S. helicopter airlines—New York Airways, Chicago Helicopter Airways and Los Angeles Airways.

These three operators, the report notes, have grown rapidly, and together carried 366,000 passengers in 1959, but their operations must still be considered experimental. All three airlines are dependent on Federal Government subsidy, which provided 63% of total revenue in 1959. To date, the transport helicopter has been most successful in airline service as a special purpose vehicle ("aerobus") transferring passengers between airports in the Chicago and New York areas. There has been only limited development of helicopter traffic between airports and downtown city centres or residential suburbs in those two areas, and in Los Angeles, where the traffic is entirely between airport and suburbs, the rate of growth has not been so fast.

The major problem has been operating cost. Lowest direct costs achieved to date have been about 20 cents/available seat mile. The 21 new multi-engine, turbine-powered helicopters on order or option for the three U.S. operators, to be in service in the 1961-1965 period, will have direct costs estimated at 10-16 cents/available seat mile. This, notes the F.A.A. report, is too high for self-sufficient operation and the need for a Federal subsidy of 25-40% is forecast at least until more economic helicopter types are forthcoming.

Passenger traffic of the helicopter airlines is expected to grow rapidly in the 1960-1970 period as a result of increasing fixed-wing traffic, greater penetration of the available market, and improved dependability of service, but no reduction in fares appears likely. By 1965, helicopter traffic is forecast to have grown to 1.2 million passengers, and by 1970 to 2.0 million. To carry these, the three airlines are expected to need 30-32 helicopters by 1965 and 40-45 by 1970. A few other cities in the U.S. have a potential requirement for scheduled helicopter services (especially Washington and San Francisco (Oakland))—but the C.A.B. has indicated it will not at present certificate additional helicopter airlines because of the cost of subsidies.

Airport shuttle service is expected to remain the mainstay of helicopter operations. V/STOL aircraft suitable for short-haul (under 250-mile) intercity operation might become available towards the end of the decade, but although offering impressive time savings they appear, at present, to have operating costs which preclude competitive fares with other means of transport. The report does not foresee development of a commuter market (15-50-mile distances) for helicopters.

OPERATING COSTS, U.S. HELICOPTER AIRLINES

Year	Per Available ton-mile, $			Per Revenue ton-mile, $		
	Total	Direct	Indirect	Total	Direct	Indirect
1955 ..	6.75	3.62	3.13	15.22	8.16	7.06
1956 ..	6.37	3.22	3.15	12.96	6.55	6.41
1957 ..	4.82	2.93	1.89	11.50	6.99	4.51
1958 ..	3.98	2.47	1.51	10.04	6.22	3.82
1959 ..	4.05	2.54	1.51	8.29	5.20	3.09

DIRECT OPERATING COSTS BY TYPE, IN SCHEDULED SERVICE 1958-1959

Helicopter	Year entered service	$ per hour flown	$ per available ton-mile	$ per available seat-mile
Bell 47	1949	54.37–54.75	4.95–5.33	—
Sikorsky S-55	1952	77.97–142.10	2.38–7.35	0.28–0.35
Sikorsky S-58	1956	208.05–260.92	1.67–3.02	0.20–0.33
Vertol 44B	1958	256.28–260.35	3.35–3.47	0.36–0.40

* "The Helicopter and Other V/STOL Aircraft in Commercial Transport," prepared by the Economics Branch, Office of Plans, and published by the Federal Aviation Agency in Washington.

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HAWKER SIDDELEY AVIATION *32 Duke Street, London, S.W.1.*

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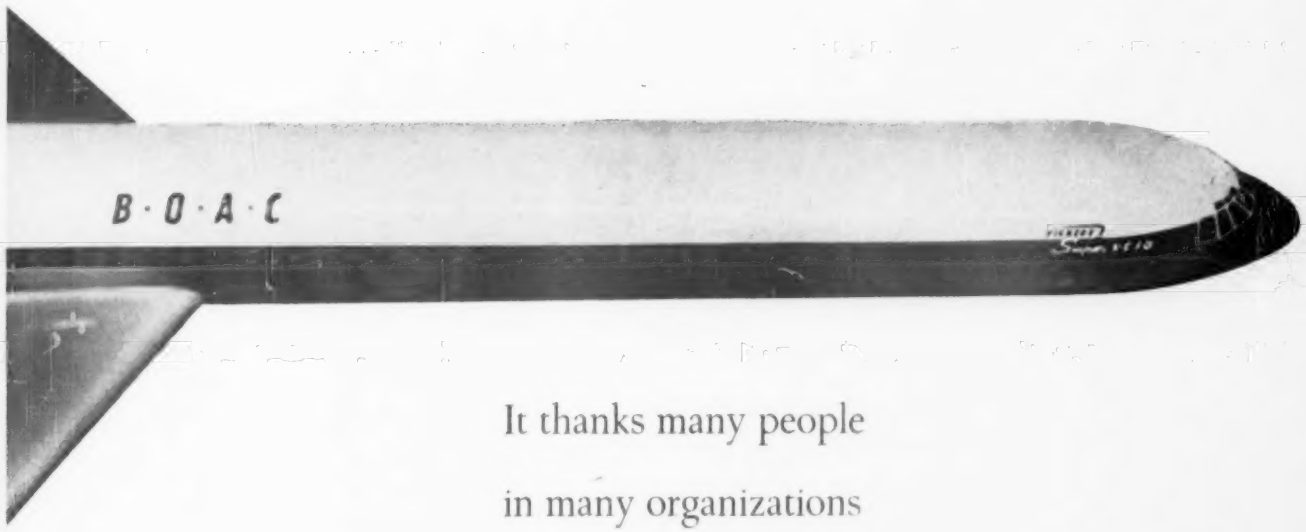
Vickers Aircraft

is celebrating its 50th year



It thanks many people

in many organizations

for their good wishes

and for their work

in helping to plan

The Shape of the Future

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE A Company of

BRITISH AIRCRAFT CORPORATION

TGA A1702

anniversary

In vapid verse we vainly try
Veraciously to versify
The valiant deeds of Vickers-A,
Victorious aviators they,
Who fifty years ago enjoyed
First voyage into aery void.
From this vertiginous volition
Began great Vickers' long tradition.
Vespa, Vincent, Vildebeest,
Viscount, Valiant, and, not least,
Spitfire and 'Wimpy' (oh dear me!
Why didn't they begin with V?).
The Vimy, two decades before,
Voyaged the vast Atlantic o'er.
(Alcock and Brown! men venerate
Your valour since that very date).
Today, as Vanguards leave the ground
Vickers are still more renowned,
And when the pundits cry 'What then?'
Of course there'll be the VC10.
Such deeds as these, and volumes more,
Made Vickers great in peace and war.
Well may you vaunt that none can vie
With your velocity in the sky.
You virile veterans, still be great
Through all vicissitudes of fate.
Victorious may you ever be.
Best vishes (sorry!)—

AIR BP

FIFTY YEARS OF ACHIEVEMENT

WEYBRIDGE, in Surrey, and more particularly that part which comprises the once famous motor-racing track of Brooklands just outside the town, has always been the centre of Vickers aeronautical activity. In the pages that follow, the story of the first 50 years of endeavour are set out.

The story begins at Brooklands in the days when the first British pioneers were building their own aeroplanes and teaching themselves to fly. When the War came Vickers had established a successful flying school and produced a steel-framed aeroplane. By the time that War ended Vickers had developed a twin-engined bomber which became the first heavier-than-air craft to cross the North Atlantic from North America to Europe.

In the Second World War, Weybridge was to be bombed, but that threat was met by dispersion in order that production and design might go on. With the coming of the gas turbine came the Viscount and the Valiant. And at the start of the next 50 years of achievement are the Vanguard and the VC 10.

From Gunbus to Valiant

VICKERS' interest in what used to be called "aerodynes," that is, heavier-than-air craft, dates from Jan. 1, 1911, when an agreement between Vickers, Sons and Maxim and Robert Esnault Pelterie of Billancourt, Seine, an early French aeroplane constructor, became operative. Previously Vickers had made the first British rigid airship *for* the Admiralty, a none too successful effort it must be admitted, but there was never any direct connection between the two enterprises, territorially, technically or traditionally.

Credit for creating an interest in aeroplanes by Vickers belongs to Captain Herbert F. Wood, a cavalryman and pioneer aviator who had served in the 12th Lancers; to Capt. (later Rear Admiral) Murray Sueter, R.N. (who had been Admiralty Overseer during the R.1 airship construction at Barrow already mentioned); and to a director of Vickers, Sons and Maxims, Mr. (later Sir) Francis Barber. The Pelterie agreement empowered Vickers "to manufacture and sell aeroplanes and engines of R.E.P. design in Great Britain and the British Colonies." An Aviation Department was formed in March, 1911, with Capt. Wood as manager, and a small design team was engaged, including Archibald R. Low and G. H. Challenger and, later on, Howard Flanders.

This team accomplished a measure of redesign on the R.E.P. monoplane with an R.E.P. engine, then regarded as one of the more successful French designs at a time when French aviation was on top of the World. This Vickers No. 1 monoplane was test flown by Capt. Wood himself at a new private aerodrome at Joyce Green, near Dartford, Kent, and shortly afterwards was taken to Brooklands Aerodrome at Weybridge for further tests, where a number of pioneers, including A. V. Roe (later Sir Alliott Verdon Roe), were already experimenting with primitive aeroplanes.

Other versions of the Vickers monoplane appeared and were used by Vickers Flying School, which had been set up at Brooklands in 1912. No. 1 was bought by Dr. (later Sir) Douglas Mawson for the Australian Antarctic Expedition of 1912, but a crash in Australia and the unknowns at that time of air reconnaissance under Arctic conditions precluded its active use. The steel-tube fuselage (an R.E.P. feature) is reported to be still among the ice and snow at Cape Denison, Antarctica.

Vickers' No. 6 monoplane took part in the Military Aeroplane Trials of 1912, but an unreliable Viale engine prevented it from proving its undoubted quality. Meanwhile, the flying school acquired some Farman-type pusher biplanes for instruction from Hewlett and Blondeau, also tenants at Brooklands. With modifications these became known as Vickers "Boxkites" and were very similar to the Bristol Boxkites being used by the Bristol Flying School, also located at Brooklands.

The "pusher" configuration no doubt set the Vickers design team thinking and it was but a step from their Hydravion type—a large-span passenger-carrying biplane, with the engine and propeller mounted behind the wings and the tail carried on openwork booms—to the Vickers fighting biplane carrying a Vickers Maxim machine-gun mounted in the nose with a free field of fire. The Gunbus, as it became known, can fairly claim to be one of the first aeroplanes designed specifically to carry armament.

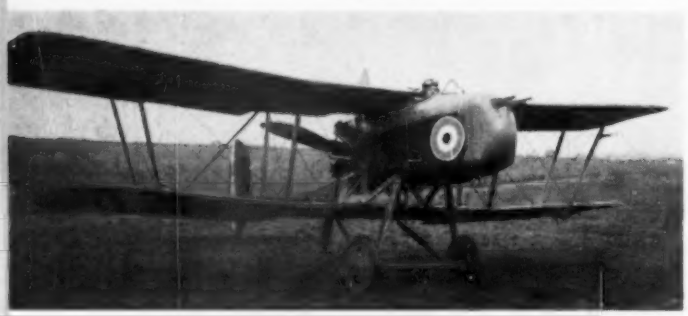
The production Vickers Gunbus, F.B.5, was accorded a War Office contract in December, 1913, and the first was delivered to the Royal Flying Corps in October, 1914. It greatly assisted in offsetting the appearance of armed enemy aircraft on offensive patrols early in the First World War and was only outmoded by more powerful two-seat fighters of the same configuration and, of course, by the appearance of German single-seat tractor fighters fitted with propeller interrupter gear for their machine-guns.

In the period up to the outbreak of War in August, 1914, Vickers aviation achievement consisted of pioneering a steel-framed aeroplane design; the establishment of a successful flying school; and the design and construction of a fighting aeroplane capable of definite action in the air hostilities that so quickly developed in the War.

On the outbreak of the War, Vickers moved their aircraft production from Erith to Crayford, some three miles away. The Vickers flying school, meanwhile, had closed down at Brooklands; but in August, 1915, a new aircraft factory was opened by Vickers in the former Itala motor works, situated outside the motor-racing track on the road running from Weybridge railway station to Byfleet village. Part of the original Itala walls still stand in the centre of the present works in that location.

Weybridge works produced a large number of aircraft during the First World War—75 B.E.2cs; 50 F.E.8s; 95 F.B.9s; 100 F.B.14s.; 65 F.B.19s; and 1,650 S.E.5as. The last-named total was the largest production of this Government-designed fighter of any in the country.

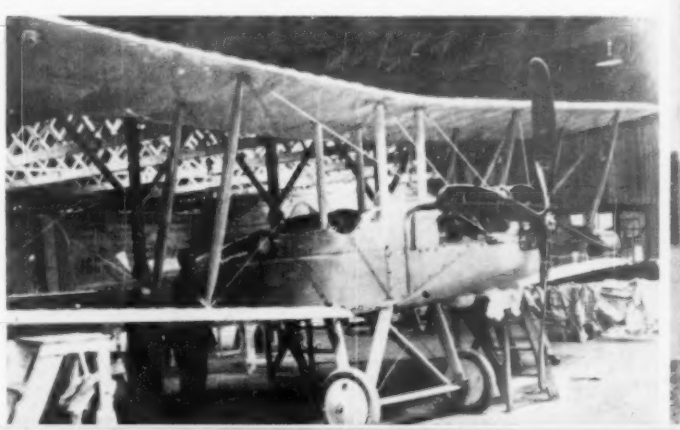
In the Crayford design office, a young Vickers-trained engineer, R. K. Pierson, a clergyman's son from Norfolk, was rapidly coming to the fore, and in his F.B.8, a twin-engined biplane fighter, began his development of the later bomber, the



Above, a descendant of the Vickers F.B.12, the F.B.26 Vampire first appeared in 1917; this is the Mk. 2 version with a 200 b.h.p. B.R. engine.

Above, a Vickers F.B.5 Gunbus on the Western Front in France in the winter of 1915.

Right, B.E.2c No. 1760, the first aeroplane made in the Weybridge works and delivered on Aug. 17, 1915.



By C. F. ANDREWS

F.B.27 Vimy, which was to earn undying fame.

Pierson was appointed chief designer in 1917, a position he held until 1945, when Mr. G. R. (now Sir George) Edwards took over on Mr. Pierson's promotion. "R.K.P.", as he was always known to his staff, was thus responsible for design throughout the period when Vickers were establishing their status as one of the leading British aircraft constructors, a tradition since so ably carried on and consolidated by Sir George Edwards who, like his predecessor, rose from the ranks.

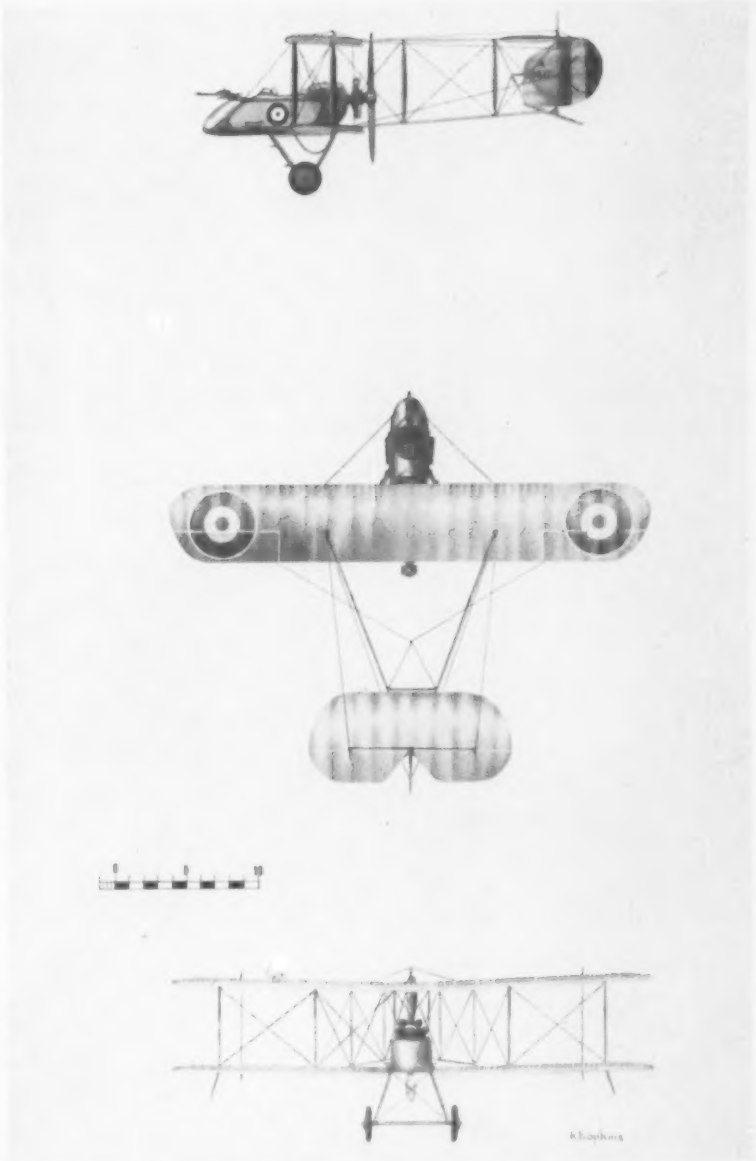
During World War I a number of interesting, though conventional, experimental designs appeared from the Vickers team, none of which, however, "hit the jackpot." It was left to the Vimy, which came to readiness for action right on the Armistice of November, 1918, to establish the hallmark of Vickers design.

The story of the first direct Atlantic flight and how it showed that regular non-stop air passage over the oceans would come in due course, has been told and retold many times. The achievement of Alcock and Brown in their Vimy-Rolls biplane on Jne. 14 and 15, 1919, was referred to by Sir George Edwards at the unveiling of the Clifden Memorial in June, 1959, in these words: "Those of us in these days, with all our modern aids to flying and navigation, still cannot quite comprehend how these men achieved this feat in their day, 40 years ago."

Ross and Keith Smith and Van Rynveld and Quintin Brand, with others, blazed the trail across the land masses, the first pair by flying a Vimy to Australia from Hounslow in 28 days and the others by valiant attempts to reach the Cape of Good Hope by air, also in Vimys.

Major Wood, as he then was, died from influenza in December, 1918, and was succeeded as manager of Vickers Aviation Department by Captain Peter D. Acland. Weybridge works throughout World War I and up to 1936 were controlled by Percy Maxwell-Muller with Archibald Knight, one of Vickers' original flying school instructors, as his first assistant. On reflection, it seems doubtful if Vickers' continuity of aircraft production, consolidated solely at Weybridge from 1919 onwards, would have survived the testing times that were to follow without the fortitude and resolution of these two men.

The same can be said of the design team, led by R. K. Pierson and his able lieutenant Paul Wyand, who was chief draughtsman from April, 1919, when the design office moved from Imperial Court, Knightsbridge, to Weybridge, up to 1951. Located in Maxwell-Muller's former residence at Pinewood House, inside the works, this small team slaved away at the multiplicity of projects which every aircraft company produced in those days, in slender hopes of gaining meagre official contracts or of selling small batches of military and civil aircraft abroad.



VICKERS F.B.9 GUNBUS.—Powered by a 100-b.h.p. Gnôme Monosoupape, the 1916 Streamline Gunbus had a span of 33 ft. 9 in., a length of 28 ft. 5¼ in. and a weight of 1,892 lb.; its top speed was 82.6 m.p.h.

The first post-War Vickers design was the Viking amphibian flying-boat, intended for operation in coastal waters and the hinterland where no satisfactory aerodromes existed, as was then the rule. The Viking Mark III, piloted by Captain Cockerell, then Vickers' chief test pilot, won the Air Ministry first prize of £10,000 for amphibian seaplanes in 1920. Most of the Viking production of 32 aircraft were variants of the Mark IV which followed, either with a Napier Lion or a Rolls-Royce Eagle, and were sold to France, Holland, Canada, U.S.A., Japan, Spain, Russia and Argentina.

In 1924, Sqn. Ldr. A. S. C. Maclaren attempted a round-the-World flight with two Vulture amphibians, which were Viking variants. With one he reached Akyab and with the other he got as far as the Bering Sea, where he came to grief in heavy fog and rough seas. Worthy of note here was a project design in 1919 for a very large flying-boat of more than 100,000 lb.

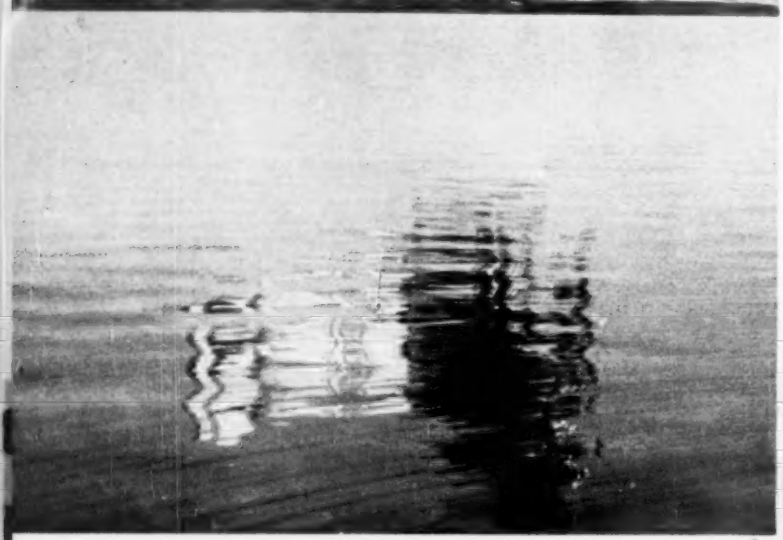
(Continued on page 857)

Left, handing over the 1,000th Weybridge-built S.E.5a on Vickers Sports Ground, Byfleet, by Major H. F. Wood (civilian clothes) on Jly. 6, 1918.

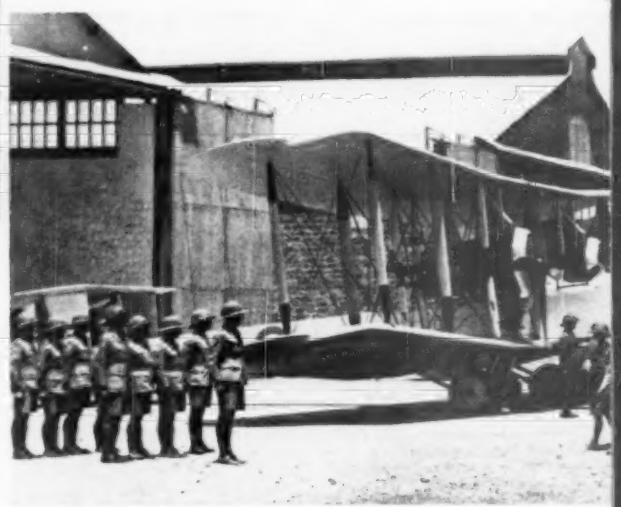
The ubiquitous Warwick on patrol with air-sea resc

Vickers' 50 Years . . . .

PAGES FROM VICKER



Above, a Vildebeest of No. 100 Squadron at Singapore dropping a practice torpedo.



Below, Vincents of No. 47 Squadron lined up for ceremonial inspection at Khartoum by Sir Philip Sassoon.

resc ue lifeboat on D Day.

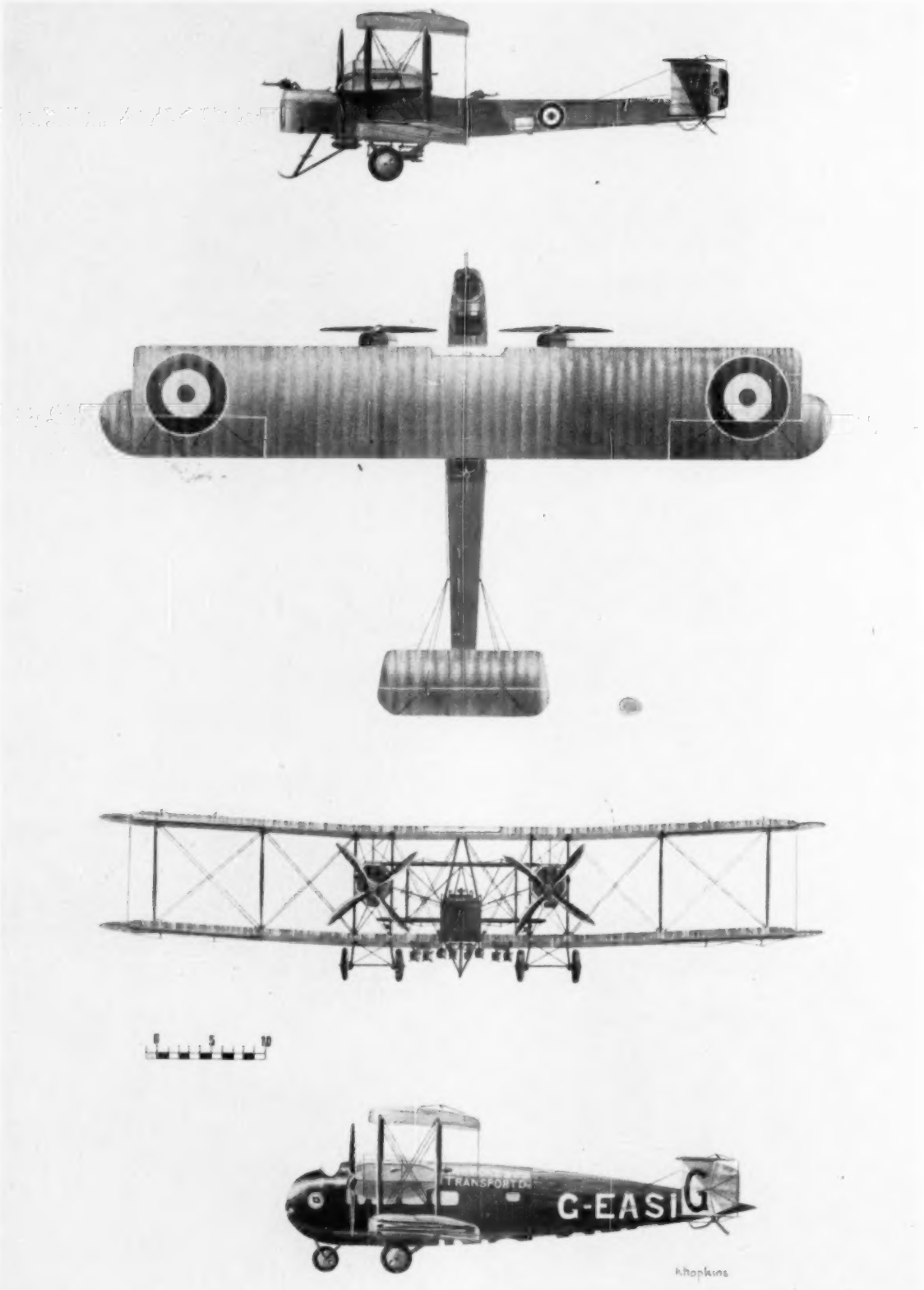
Native labour sweeping the take-off zones prior to the World Record Flight in 1938 of R.A.F. Wellesleys from Ismailia to Darwin. This precaution was necessary because of the small ground clearance of the special large-diameter propellers in the tail-up attitude.

ER S' HISTORY

Above, A.O.C.'s inspection of No. 4 F.T.S. equipped with Vimys at Abu Seuir, Egypt in 1930.

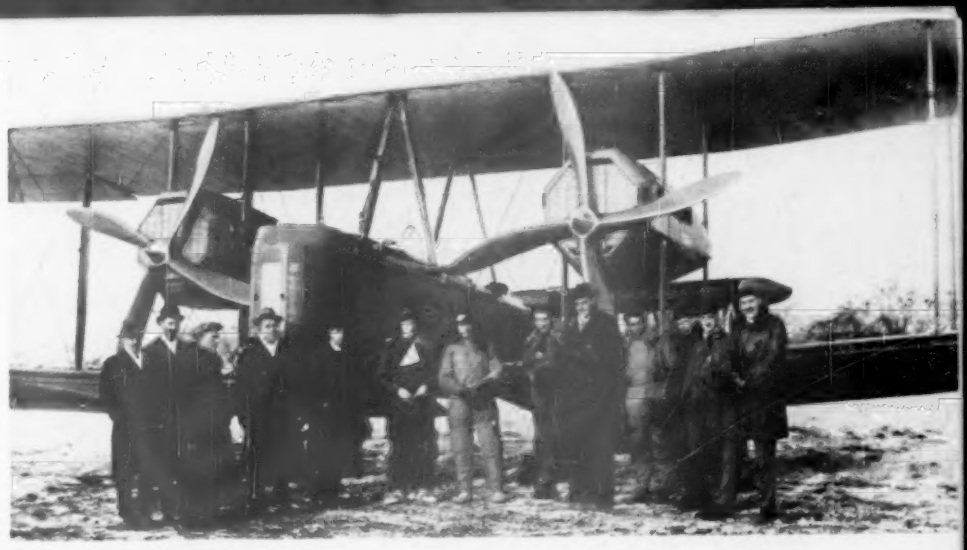
Above, a Wellesley on the way to bomb Keren in the Italian East African campaign of 1940.

Right, a Wellington DIW with magnetic ring probing Tripoli harbour for hidden mines.



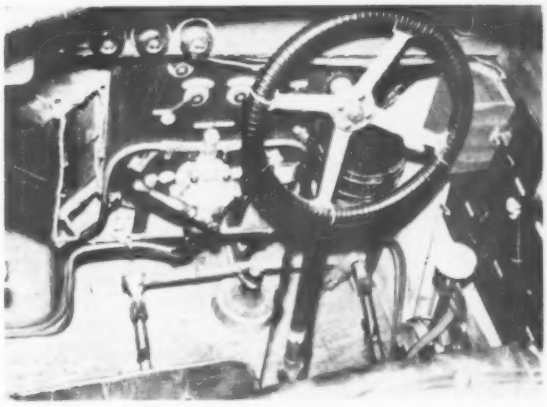
VICKERS F.B.27A VIMY.—Powered by two 360-b.h.p. Rolls-Royce Eagles, the 1919 Vimy bomber had a span of 68 ft., a length of 44 ft., and an all-up weight of 12,500 lb.; its top speed was 108 m.p.h. The Vimy Commercial of 1920 with a new fuselage (side view at bottom) had a top speed of 97 m.p.h.

Vickers' 50 Years . . . .



Right, before take-off at Hounslow for Australia on Nov. 12, 1919, stands the Vimy, now in its own museum at Adelaide Airport. Seven figures from the nose and left to right are Commander Harold Perrin, (Royal Aero Club), Maxwell-Muller, Ross and Keith Smith (both knighted later), Sgt. Bennett, R. K. Pierson and Sgt. Shiers.

Below, The Vimy Transatlantic cockpit showing the elementary control and instrumentation and the pilot's seating on the starboard side.



(*Continued from page 853*)

weight powered by eight Rolls-Royce Condors. This was still-born because of a cycle of national economy at the time.

Development continued meanwhile with other lines, the Vimy being converted for civil use by the substitution of a fat-bodied, unobstructed cabin fuselage for that of the bomber. Mostly to a Chinese order, 44 of these Vimy Commercials were made; but one, G-EASI "City of London," was in regular airline service for over five years with Instone Airlines and Imperial Airways. A military version, with Napier Lion engines, the Vernon, became the first transport aeroplane of the Royal Air Force and inaugurated the Cairo-Bagdad air-mail route. A single-engined airliner with a cabin fuselage designed like that of the Vimy Commercial, fitted with either Rolls-Royce Eagle or Napier Lion, called the Vulcan and nicknamed "The Flying Pig," was also supplied to Instones and Imperials.

Following the success of the Vimy, Vickers produced a larger aeroplane of similar outlines, the Virginia, which, with Napier Lion engines, became the standard heavy bomber of the R.A.F. from 1925 to the middle 'thirties. In all, 126 were built but there were retrospective conversions between the different Marks, only the Mk. I, III, V, VII and X being used in quantity.

Mark X was the first all-metal structure Virginia. The transport version, the Victoria, was extensively used for carrying various military stores and troops in Egypt, the Middle East and India throughout the inter-Wars period and 110 were made, again with retrospective conversions between the different Marks. A refined version, the Valentia, with Bristol Pegasus engines in place of Napier Lions, came later and 28 were made with an additional quantity converted from Victorias. One of the greater feats of the Victoria was the evacuation of the bulk of 600 civilians from Kabul to Peshawar in 1928 during the Afghan rising.

A third line of development by Vickers was also being followed at this period—the single-engined military tractor biplane, beginning with the Vixen, with variants according to requirements, in the Valparaiso, Vivid and Valiant. Chile bought 19 Vixen Vs; and Portugal acquired 14 Valparaisos, and also a licence to build more with radial engines.

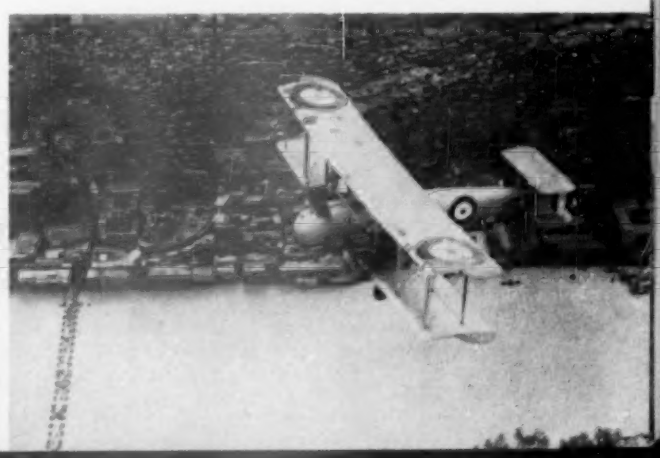
This line reached finality in the well-known Vildebeest (always spelt without a final "e") and Vincent, the former a torpedo-bomber which pioneered torpedo-dropping technique of subsequent application in war and the latter a general-purpose long-range type used extensively in the Middle East before and in the early stages of World War II; 181 Vildebeests and 197 Vincents were made.

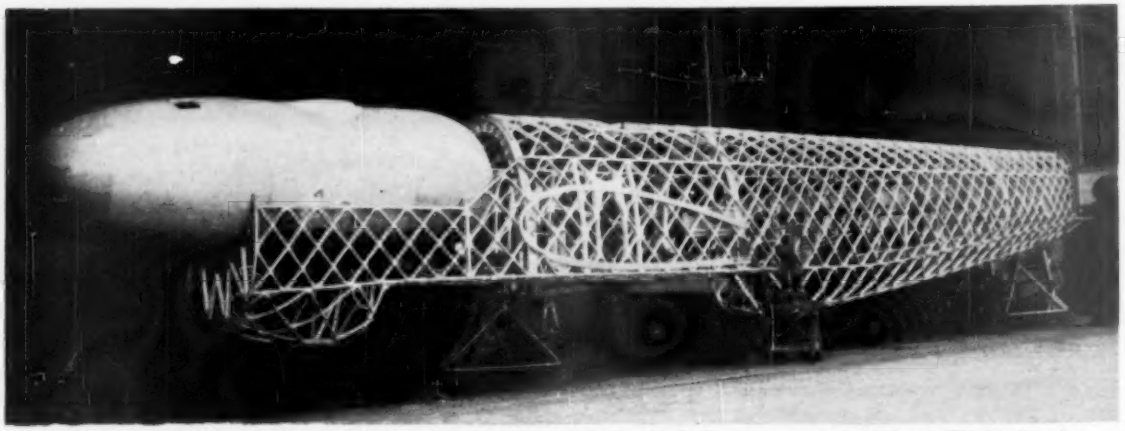
A large single-engined tractor biplane, the Vespa, powered by a special Bristol Pegasus S.3 engine, captured the World Height Record in 1932, piloted by Captain Cyril Uwins of the Bristol Aeroplane Company. Of similar scale, another biplane was made to specification G.4/31, but meanwhile Vickers were pursuing a private venture design to the same specification with a novel "geodetic" structure evolved by Dr. B. N. Wallis, who was later to become famous for the special bombs which breached the Mohne dam and who also succeeded later in getting right the aerodynamics of very large bombs.

This new structural approach led to considerable advance in weight/strength characteristics with a fabric-covered aeroplane, with the result that the Wellesley, as the P.V. monoplane was called, captured the World Distance Record in 1938. Altogether, 176 Wellesleys were made for the R.A.F., and no fewer than 11,461 twin-engined Wellington bombers, which were the successor to the Wellesley in respect of goedetic construction. Weybridge production of Wellingtons was 2,515, the remainder being made by Vickers factories at Chester and Blackpool.

Dr. Wallis has refuted the common notion that the Vickers-built airship R.100, with which he was associated, used goedetic construction. He saw the germ of his idea in the wire netting envelopes containing the ballonets of R.100 and from this he

Below, a Vickers Vernon military transport with uncowled Napier Lion engines flying over the bridge of boats at Bagdad. Below left, the Viking III Amphibian, winner of the Air Ministry competition, being shown to Members of Parliament on the Thames near Westminster.





A Wellington V under construction with a pressure cabin inserted in a standard cutaway geodetic fuselage. This Mark and the Mk. VI were high-altitude variants, the operational requirement for which failed to materialize.

Vickers' 50 Years . . . .

devised the lattice airframe. In this, loads were transferred from member to member on a criss-cross "great circle" route or as near to it as external configuration could get. The geodetic airframe posed many engineering problems, but once the intricacies had been mastered on the shop floor—largely through the drive of Trevor C. L. Westbrook, who had succeeded the old team of Maxwell-Muller and Knight—all was plain sailing.

In 1940, Lord Beaverbrook, the first Minister of Aircraft Production, "requisitioned" Mr. Westbrook, and Mr. T. Gammon of Vickers' Dartford works succeeded to the onerous post of superintendent of Weybridge works. Mr. Gammon, now deputy managing director of the aircraft company, thus was responsible for the dispersal of the Wellington production to a large number of outlying locations in the district, following the bombing of the Weybridge works in September, 1940. The success which attended this difficult operation is underlined in the Weybridge production figures quoted above.

In the Wellington, Vickers rendered a similar service in World War II to that achieved at the outset of World War I with the Gunbus, that is, of providing an air weapon capable of instant action on at least equal terms with enemy equipment.

The larger B.1/35 Warwick, which followed the Wellington and to the same pattern structurally, was delayed by slowness in the development of the high-power piston engines, for which it was designed, in the immediate pre-War period. Eventually it went into service powered by the Pratt & Whitney Double Wasp and later, the Bristol Centaurus.

By then, the four-engined heavy bombers had appeared and as the Wellington was also coming out of Bomber Command, after redoubtable service, the two Vickers' twin-engined types were allocated between them almost every other conceivable operational duty, air/sea rescue, long-range anti-submarine patrol, operational crew training, and so on. Weybridge works built all the 843 Warwicks produced.

NIGHT OFFENSIVE.—Wellingtons of Bomber Command lining up for take-off—destination, Germany.

A rapid turn-round after the War led to Vickers being foremost in the field with a new British civil airliner, the Viking, bearing the same name as the original amphibian that was Vickers' first civil effort after the First World War. Early production versions had geodetic wings and tail but an all-stressed-skin design was soon engineered and assisted the, then, new British European Airways to take to wings. In addition, of the 161 Vikings produced 65 went direct to overseas operators.

A multi-purpose transport redesign of the basic Viking was the Valetta for the R.A.F., of which 262 were made. This was followed by the Varsity "flying classroom," a specialized crew trainer, of which 160 were made at Vickers' Hurn depot.

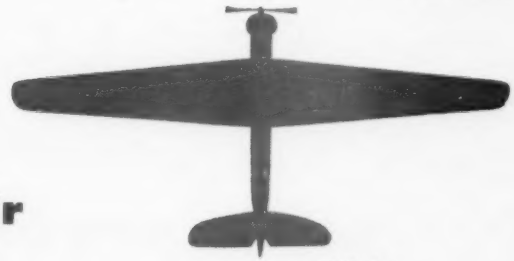
Vickers' final military aeroplane in its own right was the Valiant, an all-electric four-jet bomber designed and produced in comparatively record time for these days and first in the V-bomber force of the R.A.F. This achievement, sandwiched in between other civil developments, is now regarded as one of the company's greatest throughout the 50 years. Once more the works drive came from yet another who had come up from the ranks, A. W. E. (Charlie) Houghton. (See THE AEROPLANE AND ASTRONAUTICS, Jly. 29, 1960.)

To return to the civil developments; at the time the Viking was entering airline service, in the background the VC2 turbine airliner project was going through the pangs of birth with official foster-parents. R. K. Pierson had contrived the conception through the Brabazon Committee, but it was left to Sir George Edwards to overcome the many obstacles before his final design emerged as the Viscount.

The rest of the story is now known to the World (it was recounted in detail in THE AEROPLANE, Jly. 18, 1958). The turbine-powered airliner had arrived, thanks to Lord Douglas of B.E.A. and his chief executive, Peter G. Masefield, and above all to its champion, Sir George Edwards, and the designers of the powerplant, Rolls-Royce.

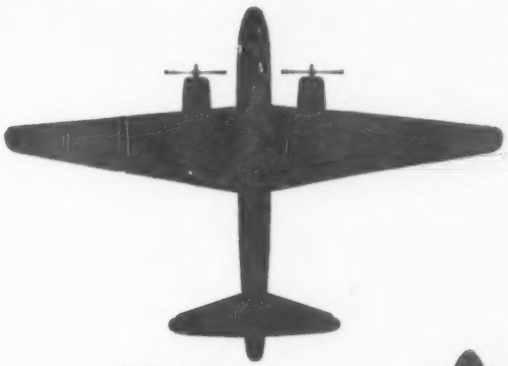
The aircraft business from any aspect is not an easy one. If this brief sketch of some of Vickers' achievements in aviation serves to show how all the sweat and tears have been worth while, then it will have fulfilled its purpose. And so, on to the Vanguard, the VC10, the Super VC10 and the British Aircraft Corporation, to whom Vickers have bequeathed a notable heritage.

Congratulations to Vickers on their 50th anniversary

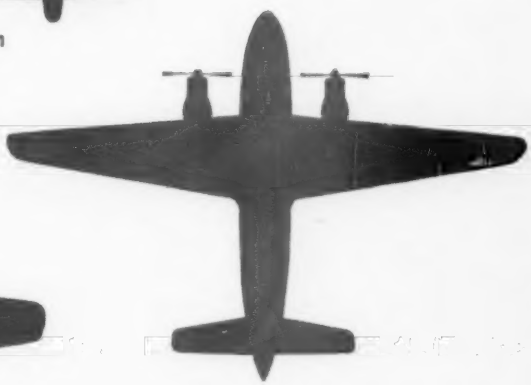


Wellesley

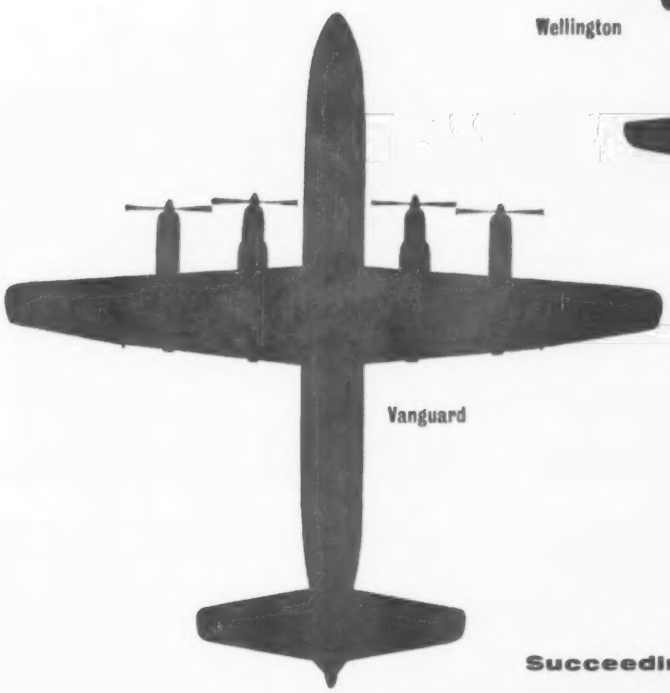
Spitfire



Wellington



Viking



Vanguard

Succeeding generations of Vickers aircraft have been fitted with

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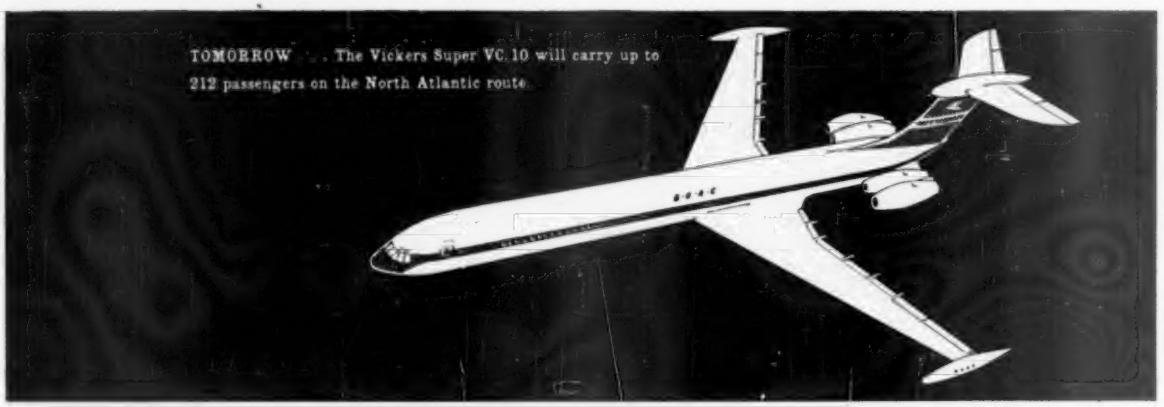
JUNE 14TH, 1919: The Vickers Vimy of Alcock and Brown takes off on its historic first air crossing of the Atlantic . . . finished in Cellon dope.



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Vickers' 50 Years . . . .

Recalling the Early Vickers Days at Brooklands

The founder editor of THE AEROPLANE, *the late* CHARLES G. GREY, *had completed a book of reminiscences before his death in 1953. This work "Bats from My Belfry" has yet to find a publisher. We are grateful to Peggy Grey (now Mrs. Colin Parker), holder of the copyright, for permission to publish the following extract.*

NOW I think we ought to turn to the Brooklands people. Major Lindsay-Lloyd, who managed the motor track, in succession to a Pole named Rodakowski, who for his part could see no sense in aeroplanes, was an enlightened Sapper officer and saw that there was a great future for flying, so he induced the Locke-Kings to level the whole of the inside of the track to make it smooth enough for the aeroplanes of those days to get on to and off it. There were certain hazards about Brooklands as an aerodrome. The banking of the track most of the way round caused queer downdraughts whichever way the wind blew. The St. George's Hill Golf Course on the east also had curious effects. The River Wey, on which Weybridge stands farther down, meanders across the land, coming in by a tunnel under one end of the track and going out by a tunnel at the other. And all along the south-west side of the track is a high embankment on which runs the main line of the London and South Western Railway, as it used to be called in what used to be known as the Bad Old Days, when legal Parliamentary fares were 1d. per mile. And a final hazard was, and still is, the local sewage farm, a large corner of which projected into what ought to have been the most used and usable part of the aerodrome.

The aeronautical inhabitants of Brooklands were of two kinds, those who had lots of money and those who had none. By December, 1909, there were about a dozen sheds at Brooklands put up by Major Lindsay-Lloyd and offered at a rent of £100 a year, payable quarterly in advance: Wherein he was wise. But the first tenants were generally young sportsmen who had money and had taken to flying for fun.

Mr. Grey then writes about the first tenants, beginning with Claude Grahame-White. Then there was "the Martinsyde Conspiracy, a thing of joy," among whose staff was the young Sydney Camm. Two of the first arrivals at Brooklands were T. O. M. Sopwith and A. V. Roe. There were many more, including all sorts of odd people of whom "C.G.G." has various things to say. But then we come to 1910 and can go on in "C.G.G.'s" own words.

In 1910 a whole range of sheds at Brooklands was taken over by Vickers, Ltd., who had just started an aviation department. They made the bits and pieces of the machines at Crayford in Kent, and assembled them at Brooklands. The chief of the Vickers outfit was Major Herbert Wood, of the 12th Lancers. He was full of energy and ideas, and like nearly all cavalrymen he was a very good pilot. His deputy was Captain Peter Acland, an Indian cavalryman.

At the start they got together a most weird menagerie of machines, because Herbert Wood wanted to try out various things before settling down to a policy. They bought a Farman boxkite, and an R.E.P. (Robert Esnault Pelterie) all-steel-tube monoplane, and a Blériot. Also the first machine which they built themselves was an all-steel monoplane designed by Mr. A. R. Low, a regular trained engineer, no relation to the well-known Professor A. M. Low (now dead).

Also Vickers took the agency for the R.E.P. five-cylinder fan-wise engines; they had a five-cylinder radial Italian Viale, and they had a 50 h.p. rotary Gnôme. Then they changed them about from one machine to another to see what the effect was.

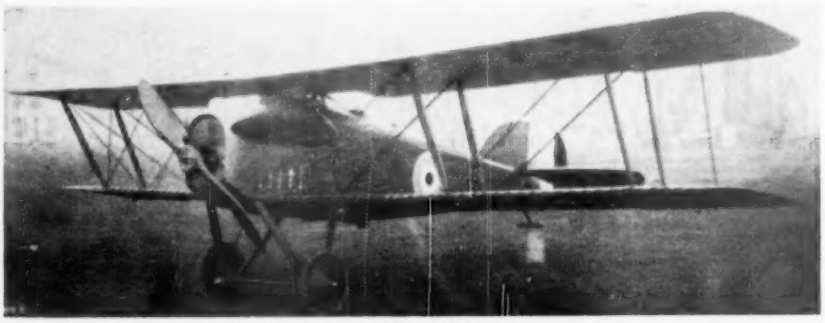
But the greatest curiosity was an airscrew, or propeller, the blades of which were curved like a Turkish scimitar. At this date I cannot remember whether it ran points first or with the points trailing. But the amusing thing is that in the year 1949 when people were talking about jet propulsion and swept-back wings, somebody came out, as a great new idea, with the notion of sweeping back the tips of the blades of propellers

Another joke was that whatever engine was fitted with this curved propeller, and no matter in which machine it was used, whether in the pusher Farman or the tractor R.E.P. or the tractor Blériot the machines always flew better with it than with any other screw. Nobody ever discovered why. Ultimately it was broken by running into something. So far as I can remember nobody ever made another one like it. The explanation simply was that its pitch happened to suit each aeroplane and its blade area happened to suit each engine better than did any other airscrew at the time.

When war broke out in 1914 Major Wood and Captain Acland were each hauled off to join their cavalry regiments,

IN THE BEGINNING.—Personnel of Vickers Flying School at Brooklands with a Vickers monoplane (R.E.P. engine). On the left, in cap, is Archie Knight, and on the right, also in cap, is Harold Barnwell, flying instructors. Barnwell was a brother of Capt. Frank Barnwell, the famous Bristol designer. The monoplane has a scimitar propeller of the type referred to by C.G.G.

Vickers' 50 Years . . . .



LITTLE TRACTOR BIPLANE.—C. G. Grey does not specify which of the Vickers tractor biplanes was the one in which Harold Barnwell turned over. This particular photograph shows the Vickers 16H Scout with the 300 h.p. Hispano-Suiza water-cooled engine.

but Vickers, Ltd., managed to get them back as indispensable producers of armaments. Before he came back Bertie Wood saw much active service in the retreat from Mons, including accompanying his Lancers when they were hurled in an old-fashioned cavalry charge against German barbed wire, which gave him a pretty poor opinion of the intellect of senior Army officers.

During the War Vickers did very good work. One thing they did at Brooklands, actually before War was declared, was to produce the first "gun-bus." It was a pusher, very much like the Farman only cleaner and better built, and it carried a machine-gun in front of the passenger's seat in front of the pilot. I believe that two or three squadrons of them were used in France and were quite useful in ground-strafing. The designer of the gun-bus, one Challenger, also invented an interrupter gear which allowed a machine-gun to fire through the blades of an airscrew without actually hitting them. But he faded quietly out of air history.

One of the characters of the Vickers' outfit was an instructor named Knight. He was a great big burly lad, and immensely strong. Once he was starting an engine, by the method usual in those days of pulling the airscrew round by hand, as one would use the starting handle of a car, when the engine fired unexpectedly and he slipped so that one of the blades came round and hit him on the head. The airscrew broke but his head did not. And I imagine that he is the only [living] example of a man who was hit on the head by an airscrew and was not killed, or, alternatively, ever broke an airscrew with his head.

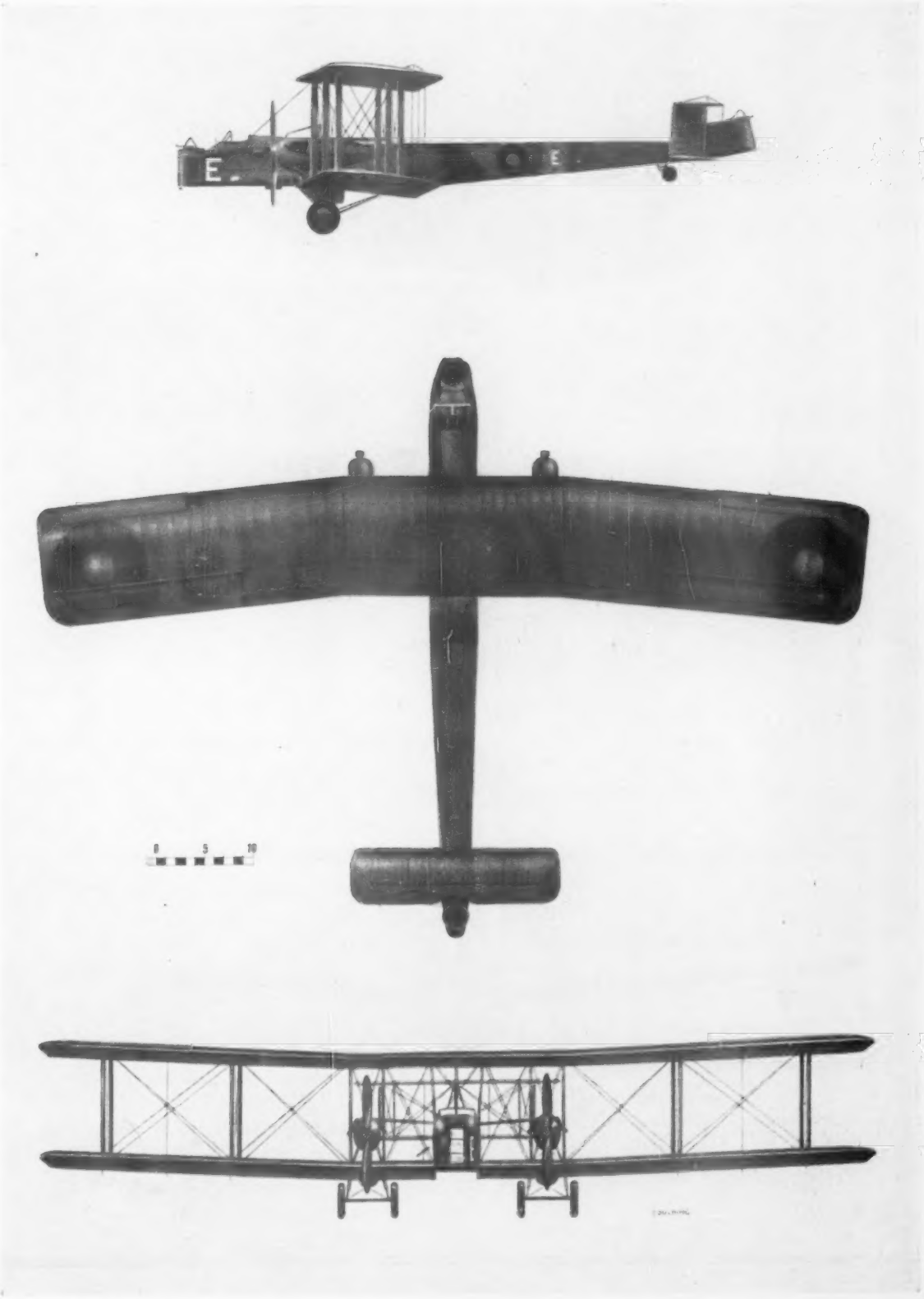
I have remarked earlier that one of the features of Brooklands was an arm of the sewage farm which projected into what ought to have been part of the fairway. There was also a down-draught over the sewage farm, because of the damp soil, and unless a machine were flying fairly strongly it was apt to drop into it. And that always meant rebuilding the machine. One day Knight, with a passenger sitting in front of one of the box-kite Farmans, was crossing this arm of the sewage farm when he was gently sucked down into it, only a few yards from the edge. As the undercarriage sank into the ooze the pupil was thrown out on his face and his hands and knees, almost bridging the space between the machine and the edge. Knight calmly rose in his seat, put one foot on the pupil's back and lightly leapt to the edge of the grass. When reproached for his inhumanity he remarked casually: "Well, I did not see why we should both get dirty." And the pupil was none the worse.

The Vickers' chief instructor at Brooklands later was Harold Barnwell, a brother of Frank Barnwell, who designed the famous Bristol Fighter which did so wonderfully in 1917 and 1918. The Barnwell brothers had built and hopped and crashed a big biplane in Scotland in 1909.

Harold instructed pupils and tested all the new Vickers' machines. I remember his turning one of their little tractor biplane fighters upside down after landing very fast. There he was suspended upside down in his shoulder-straps calmly waiting for some of us to go and hold him so that he could release the straps and be let down lightly. He said he wasn't going to let the straps go and fall out on his head even though the fall was only a matter of inches.

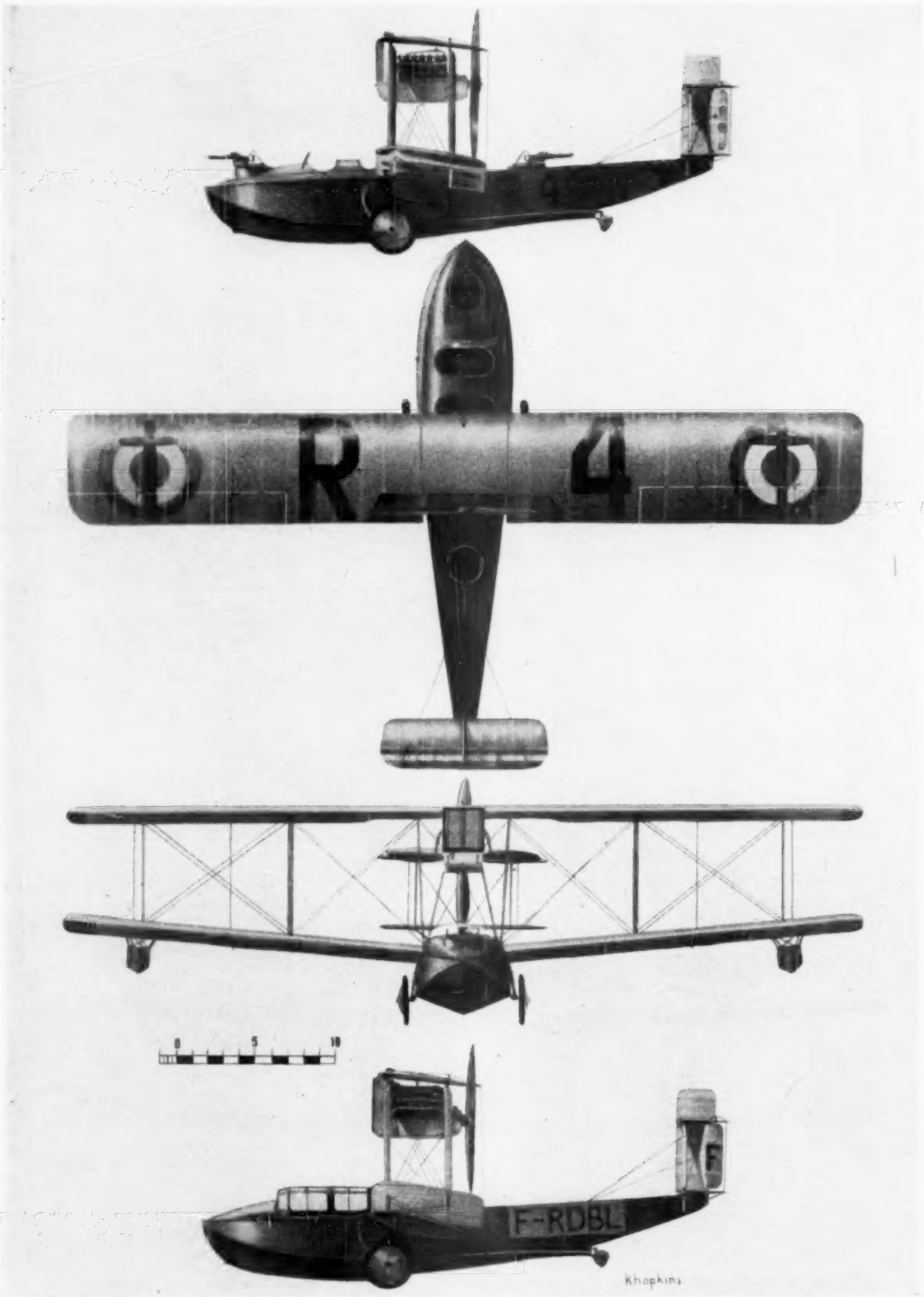
By the way, before we got to that stage of flying at Brooklands I may say that the test for a Pilot's Certificate by what had then become the Royal Aero Club, was that the supplicant-pilot had to fly three circuits of no matter what diameter or at what height, and then make a landing without breaking anything. I remember acting as official observer to George Barnes when he did his certificate flight on a Humber copy of a Blériot. I lay flat on the ground to make sure that his wheels were clear of the grass all the way round the circuit. Try lying on your stomach and wriggling round 360 degrees three times non-stop. It is good for the digestion.

ALL-METAL COMMERCIAL.—A Vickers Viastra (two Bristol Pegasus) which was used by West Australian Airways in the early 'thirties.



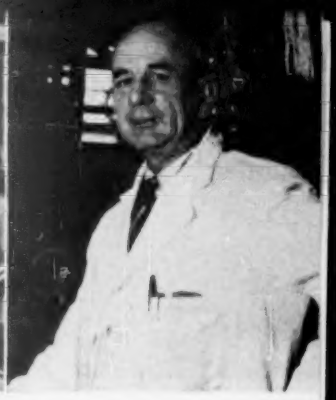
VICKERS TYPE 139 VIRGINIA X.—Powered by two 580-b.h.p. Napier Lions, the 1930 Virginia heavy bomber had a span of 87 ft. 4 in., a length of 62 ft. 4 in., and an all-up weight of 17,600 lb.; its top speed was 108 m.p.h.

Vickers' 50 Years . . . .



VICKERS TYPE 73 VIKING IV.—Powered by a 360-b.h.p. Rolls-Royce Eagle, the 1921 Viking amphibian for the Argentinian Navy had a span of 50 ft., a length of 34 ft. 2½ in., and an all-up weight of 5,650 lb.; its top speed was 100 m.p.h. At the bottom is a side view of a French civil Viking with a 450-b.h.p. Napier Lion.

Above left, W. J. B. Titcombe, senior design draughtsman (July, 1919); above right, T. C. Parker, M.B.E., general works manager (August, 1915).



Above left, E. A. Mounter, chief technical librarian (February, 1919); above right, W. G. Parker, senior foreman, electrics (January, 1918).

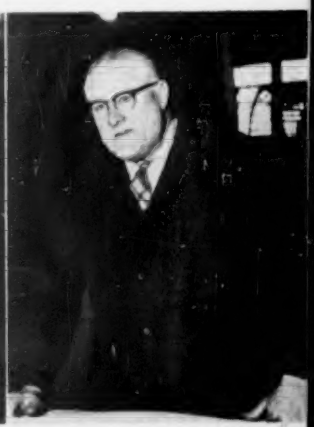
LONG SERVICE AT VICKERS—1

On this and the following page are some of those who are still with the company, having joined it 40 years ago

Photographs copyright "The Aeroplane and Astronautics"

Above left, Miss A. M. Wisbey, telephone switchboard supervisor (May, 1916); above right, E. J. Gilbert, M.B.E., assistant works manager (January, 1915).

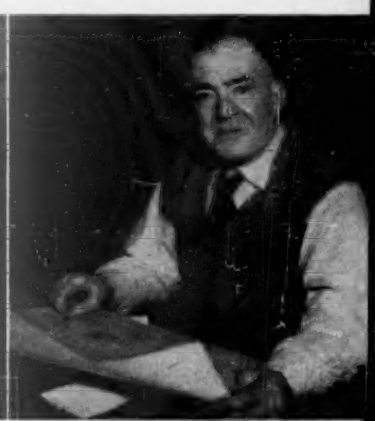
Below left, M. M. Marshall, tracer-checker (March, 1918); below right, W. Montague, fitter-erector (February, 1918).



Above left, H. E. James, toolmaker (July, 1915); above right, H. Lambert, fitter-erector (January, 1918).

Below left, R. H. Gray, senior designer (May, 1914); below right, R. T. Cox, tinsmith (April, 1920).

Below left, E. S. Chidsey, senior foreman, carpenters (October, 1915); below right, A. Clay, fitter assembler (August, 1916).



Above left, R. A. Firman, senior design draughtsman (March, 1909); above right, E. H. C. Tullett, manager, Hurn depot (March, 1917).

Above left, A. R. Bullen, chief ordering officer (November, 1919); above right, S. A. Flack, apprentice instructor (April, 1920).

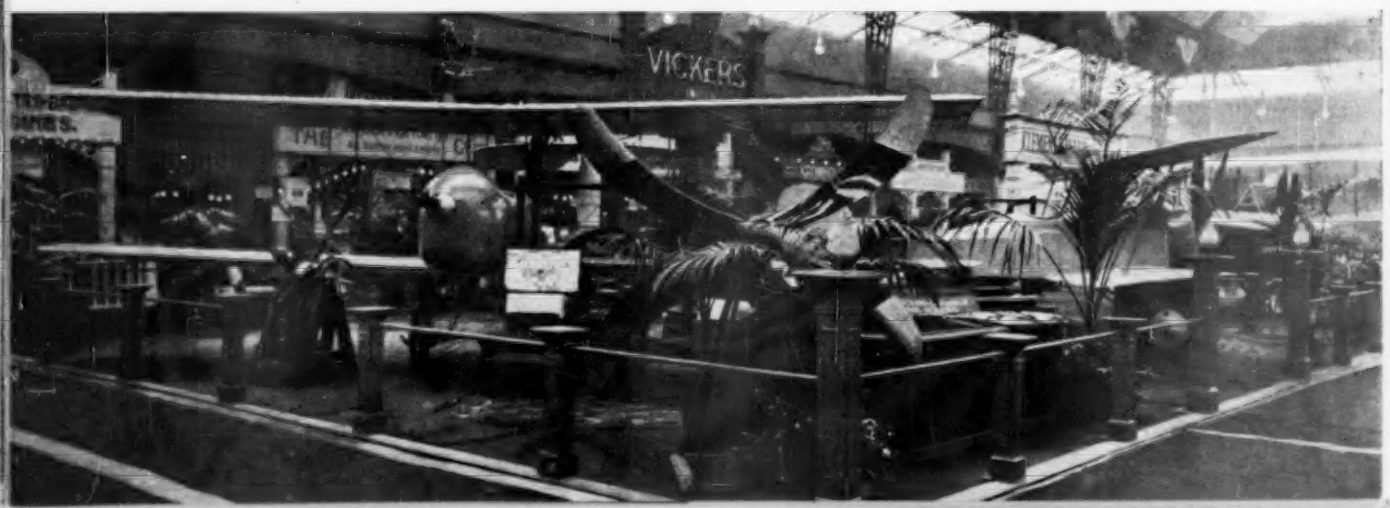
Above, left to right, E. A. Harvey, works funds manager (September 1916); J. Steer, export packer (May, 1920); E. Holden, senior foreman, stretch forming dept. (March, 1918).

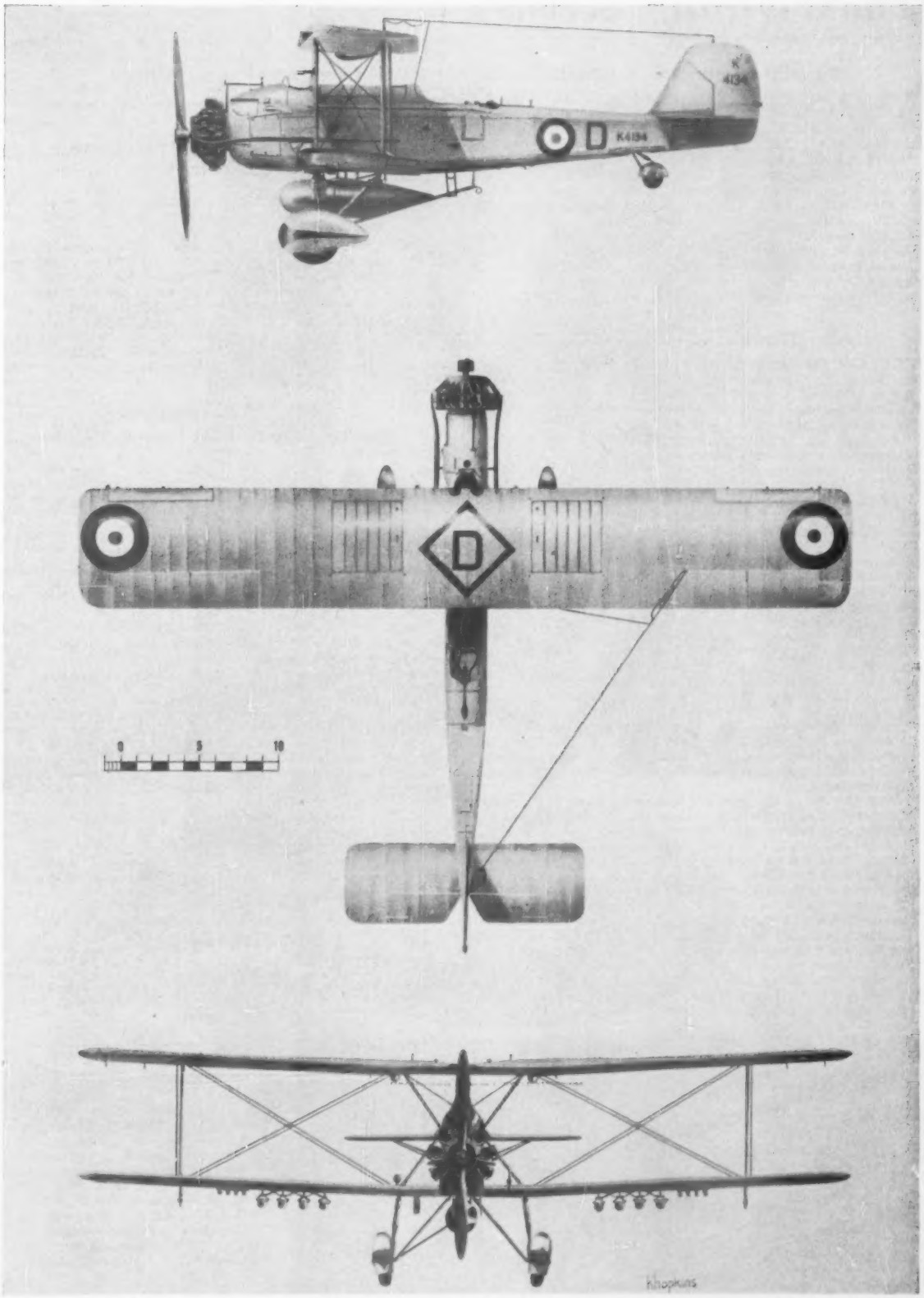
LONG SERVICE AT VICKERS—2

Above, C. V. Smith, senior foreman, toolroom (March, 1916).

Above, left to right, F. Camm, foreman, machine shop (April, 1917); H. A. Douglas fitter-assembler (February, 1917); C. M. Smith, timekeeper (October, 1919).

Vickers' stand at the Aero Show at Olympia in 1914; the aircraft on show is a Gunbus.





VICKERS TYPE 266 VINCENT.—Powered by a 650-b.h.p. Bristol Pegasus, the 1934 Vincent general-purpose military biplane had a span of 49 ft., a length of 36 ft. 8 in., and an all-up weight of 8,100 lb.; its top speed was 142 m.p.h.

The Fighting Services

Coastal Command S.A.S.O.

AIR COMMODORE K. V. GARSIDE, D.F.C., is to become Senior Air Staff Officer, Coastal Command, on Jan. 1, with the acting rank of Air Vice-Marshal, in succession to Air Vice-Marshal W. E. Oulton, C.B. C.B.E., D.S.O., D.F.C., who is retiring from the Service at his own request.

Between 1952-54 Air Cdre. Garside served on staff duties with the Supreme Allied Commander Atlantic at Norfolk, Virginia. He then returned to the United Kingdom to serve successively as officer commanding R.A.F. Topcliffe, Senior Air Staff Officer, Headquarters No. 19 Group, Coastal Command, and A.O.C., Maritime Headquarters, Chatham, before joining Allied Forces Central Europe as Deputy Chief of Staff (Logistics and Administration) in August, 1958. He then became Director of Quartering at the Air Ministry.

Death of an Airfield

FOLLOWING in the footsteps of many other well-known World War Two fighter stations flying has now ceased at R.A.F. Debden. It is a little more than 23 years since No. 87 Squadron, equipped with Hawker Furies, moved in to become the first flying unit in this quiet corner of North West Essex.

Although the airfield has a comparatively short history it is nevertheless one worth noting. At the outbreak of war two Hurricane squadrons, Nos. 85 and 87, and the Blenheims of No. 29 Squadron formed the station's contribution towards the Air Defence of Great Britain. As a sector station during those four vital months in 1940, August to November, the Hurricanes, Blenheims, Beaufighters and Defiants operating from the airfield claimed 110 enemy aircraft destroyed, 33 probables and 60 damaged for the loss of 33 aircraft and only 11 aircrew.

In April, 1941, Debden became "home" to the first of the American Eagle Squadrons, No. 71, and when joined in September, 1942 by its two sister squadrons, Nos. 121 and 133, all three were transferred to the U.S.A.A.F. During March, 1943, these Squadrons exchanged their Spitfires (somewhat reluctantly it is understood) for the P-47 Thunderbolt and shortly afterwards the station was officially handed over to the U.S. 8th Air Force becoming part of the 65th Fighter Wing of the 2nd Air Division. It was the task of the ex-Eagle Squadrons to act as long-range escorts to the American daylight bombing raids and on Jly. 28, 1943, they provided the first fighter escort to cross the German border in operations from England and later, when the Thunderbolts had been superseded by P-51 Mustangs, they gave cover to the first B-17 Fortress raid on Berlin.

With the end of the War and its handing back to the R.A.F. in September, 1945, Debden became the Empire Radio School and flying rather naturally became of secondary importance. However, the school's demonstration aircraft, a Halifax named Mercury, and later a Lincoln—Mercury II—made many overseas goodwill tours until the latter was relegated to a ground demonstration aircraft in 1950. With the disbandment of the Empire Radio School in 1949 and the formation of the Signals Division of the R.A.F. Technical College, the Technical Training Command Major Servicing Unit moved to Debden and this was followed later by the Command Instrument Rating Flight. These two units kept the airfield busy right up until recent months along with No. 651 Light Aircraft Squadron of the Army Air Corps whose Austers and Skeeters were a familiar sight in local skies from 1957 until March of this year.

On Sept. 7 last the station once more changed hands, this time to become the R.A.F. Police Depot and, under the command of Gp. Capt. S. N. Kettle, O.B.E., it is now actively engaged in this rôle. Undoubtedly one of the major factors which has brought about the closure of the airfield is the congested air-space in this part of East Anglia. All that one can hope for is that perhaps one day it will be given a new lease of life and become its former self.—R. S. HANKIN.

Director of Aircraft Engineering

GROUP CAPTAIN S. W. LANE, C.B.E., who, since last August, has been with the Ministry of Aviation as Chief Aircraft Supplies Liaison Officer, recently became Director of Aircraft Engineering at the Air Ministry with the acting rank of Air Commodore.

Joining the Service in 1926 as an aircraft apprentice at Halton, he was trained as an aero-engine fitter and in June, 1940, was commissioned in the Technical Branch. He took the 1947 course at the Joint Services Staff College, joined Air Command Far East in 1948, and from September, 1951, spent 2½ years on the Directing Staff at the R.A.F. Staff College, Bracknell. In August, 1953, he took command of No. 49 Maintenance Unit at Colerne. He was appointed Senior Technical Staff Officer at Headquarters, No. 41 (Maintenance) Group, in 1955.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Wg. Cdr. G. S. Fry, D.F.C., and Wg. Cdr. D. P. J. Smith, D.F.C., to the Department of the Chief of the Air Staff; Wg. Cdr. J. H. C. Russell to the Department of the Air Member for Personnel; Wg. Cdr. L. Cottingham, D.F.C., Wg. Cdr. F. Walker, M.B.E., and Sqn. Ldr. N. E. Wilkins, D.F.C., with acting rank of Wg. Cdr., to the Department of the Air Member for Supply and Organization.

Fighter Command: Wg. Cdr. W. L. Green, D.F.C., to the School of Land-Air Warfare for transport support duties; Sqn. Ldr. D. O. Luke to R.A.F. Leuchars to command No. 151 Squadron, with acting rank of Wg. Cdr.

Coastal Command: Wg. Cdr. R. T. W. Evans, M.B.E., to Headquarters as Command Armament Officer.

Flying Training Command: Wg. Cdr. J. D. Thirlwell, O.B.E., D.F.C., to the R.A.F. Flying College, Manby, as Assistant Commandant, with acting rank of Gp. Capt.; Wg. Cdr. R. F. Starnes, D.F.C., to the R.A.F. Staff College, Bracknell, for directing staff duties; Wg. Cdr. B. A. Colvin to R.A.F. Tern Hill to command the Administrative Wing; Wg. Cdr. A. F. Clegg to R.A.F. Cranwell as Senior Dental Officer.

Technical Training Command: Wg. Cdr. H. Mundy to Headquarters, Provost and Security Services, as Assistant Provost Marshal (Operations); Wg. Cdr. D. J. McKechnie to R.A.F. Uxbridge as Senior Dental Officer.

R.A.F. Germany: Gp. Capt. M. C. Dutt to R.A.F. Hospital, Wegberg, as specialist in dental surgery; Wg. Cdr. P. N. Farlow to Headquarters for organization duties.

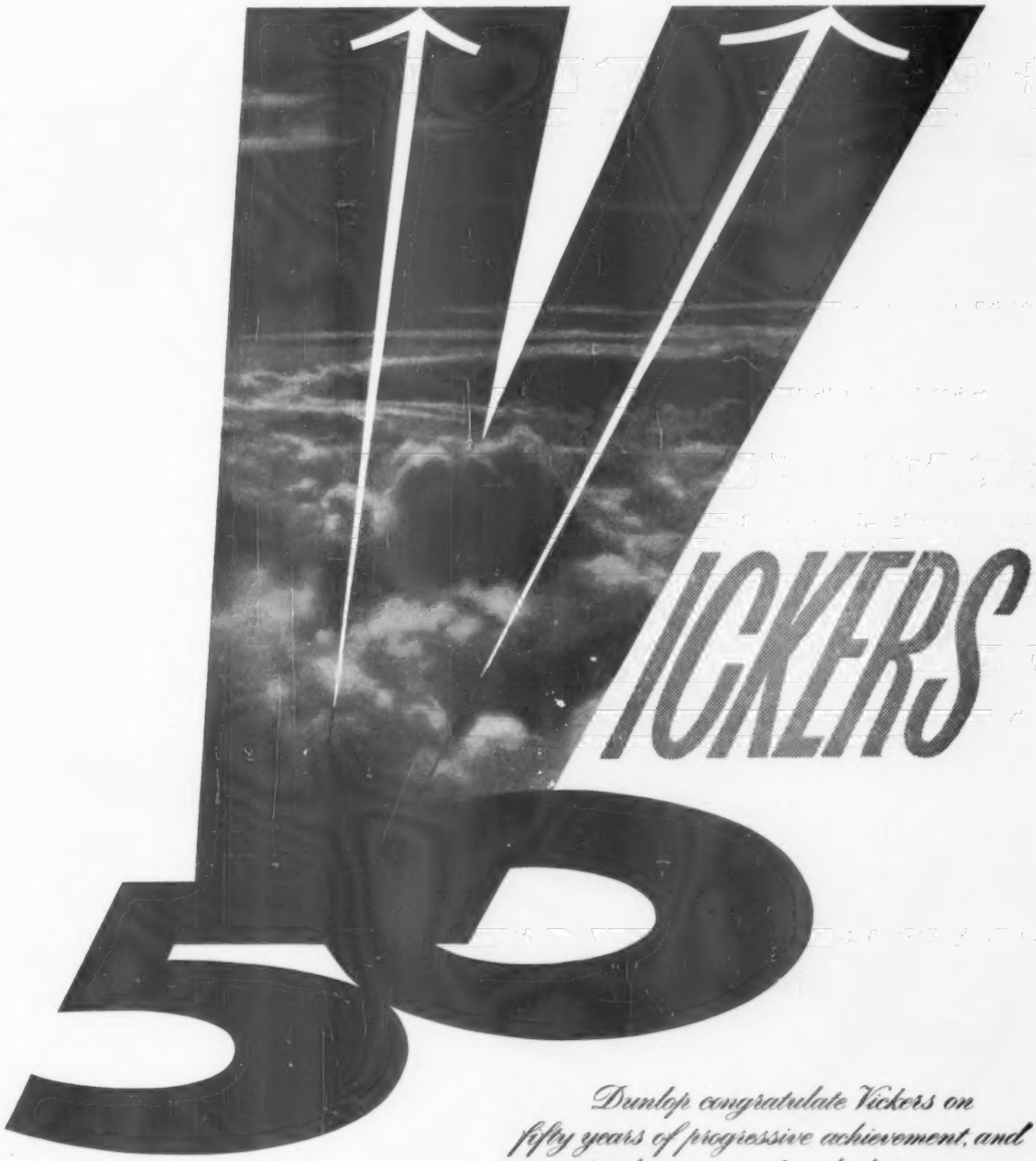
Other Appointments: Sqn. Ldr. J. C. Marmion, O.B.E., to the British Defence Staff, Washington, with acting rank of Wg. Cdr.

More Service News

No. 38 Group Reunion.—The 15th annual general meeting and reunion dinner of the No. 38 Group Old Comrades Association will be held at the Victoria Hotel, Buckingham Palace Road, London, S.W.1, on Mar. 11 at 18.30 hrs. Tickets, price £1 each, may be obtained from the Hon. Sec., Mrs. L. C. Rendall, Bailey's Hotel, Gloucester Road, S.W.7.

AUSTRALIAN BELLS.—One of the 11 new Bell 47G-2s belonging to the recently formed No. 16 Australian Army Light Aircraft Squadron is seen here piloted by the commanding officer, Wg. Cdr. K. V. Robertson, D.F.C., A.F.C., R.A.A.F. Based at Amberley, the Squadron came into existence on Dec. 1 following the disbandment of No. 16 A.O.P. Flight at Canberra.

1911 1961



Dunlop congratulate Vickers on fifty years of progressive achievement, and are proud to have enjoyed with them an association extending over many years.

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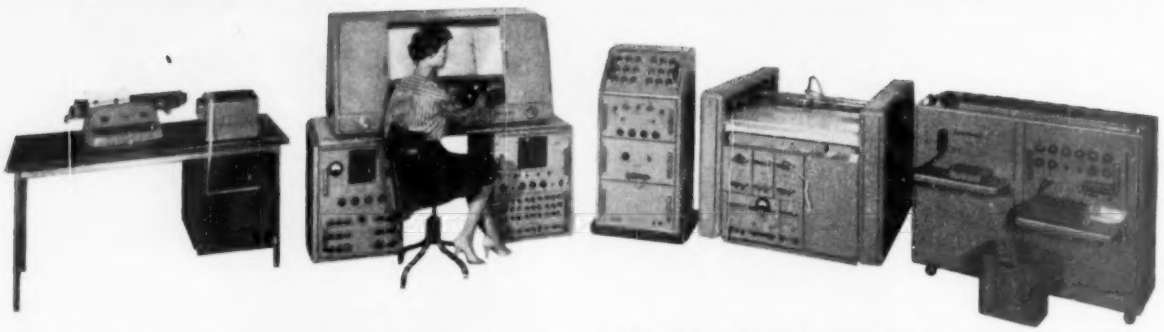
CDH/AV/1

d-mac TRACE ANALYSIS EQUIPMENT



The d-mac Data Reduction Equipment installation illustrated was supplied for analysis of flight trials of the new Vickers "Vanguard" airliner.

This comprehensive equipment enables traces of all widths up to 13 in. to be measured. The resultant information may thereafter be shown on a tabulated list, punched tape, or a graph may be drawn directly with different scales or non-linear corrections applied. If required, a graph may be plotted from a keyboard or punched tape input. Installations can be designed to meet any particular problem and need not be as comprehensive as that illustrated in this advertisement.

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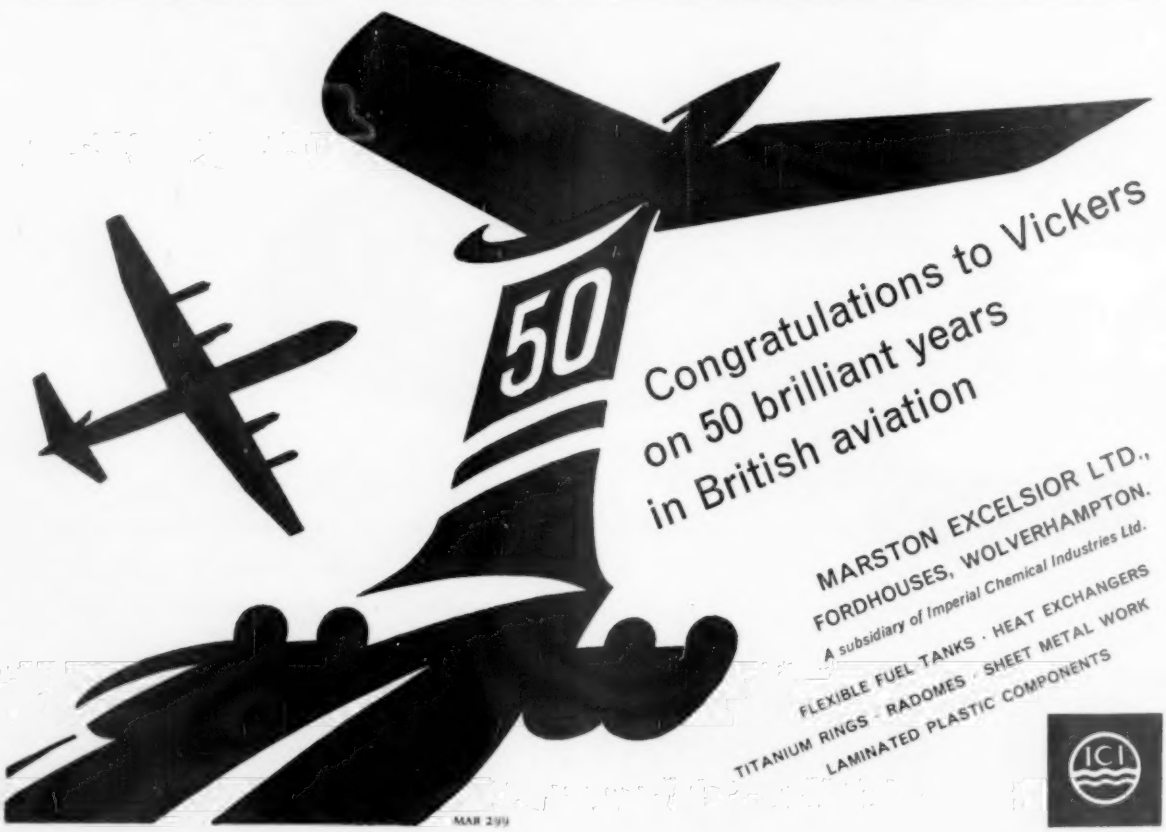


Introducing a Turbojet Fleet

H. A. TAYLOR *discusses the preparations and the operational and training techniques developed by K.L.M. for the DC-8.*

NOBODY inside, or even outside, the aviation business imagines that new aircraft fleets are ordered and operated without a great deal of prior planning. But not everyone may realize quite how soon the thinking must start, or how thorough this thinking and planning must be when the re-equipment programme involves major changes in operational techniques—and especially when commercial survival and success are at stake.

K.L.M. ordered eight DC-8s in November, 1955, and increased the number to 12—five of the total to be turbofan variants for delivery a year later than the initial series—in May, 1959. Serious work on turbojet operational problems had started in the autumn of 1953 and selected aircraft captains were already taking part in this work during 1954.

This "paper jet" programme, begun as a series of studies for the assessment of regularity on North Atlantic flights, eventually became a valuable means of training and indoctrination as well as an investigation of potentialities. The performance figures used were initially those for the Comet 3; later they were for the Douglas projects as estimates began to become available. Bypass and turbofan engine prospects were being studied before the end of 1958 and the turbofan version of the DC-8 was ordered as soon as this variant was offered by Douglas.

It was in 1958, too, that K.L.M. started to make use of a computer for the production of detailed performance tables. A complete set of these cruise tables—a vast work from which simplified curves are drawn for use by the flight crews—would involve some 1-1½ man-years if worked "by hand," but they can be turned out by K.L.M.'s I.B.M. 705 computer in about three hours. Speed of computation was particularly important in the case of the DC-8, for which finally revised performance figures were available for the long-haul version only a few weeks before the first delivery to K.L.M.

Thanks to thorough pre-planning and training the DC-8s were able to start at very reasonably high utilization levels from the first month of operation. The figure rose from 6½ hr. per day in May/June (the first month) to rather better than 10 hr. in July and August. Only three others among 12 DC-8 operators recorded a higher figure during the first month, and 10 hr. per day is getting well along towards the 4,000 hr. per annum which is the minimum target to be aimed at with modern big-capacity turbojets which probably cost something like £1 each for every minute spent on the ground.

This good initial utilization was possible because of an adequate team of fully trained engineers and flight crews. K.L.M. had 114 trained engineers—many of whom had been on a maintenance course at Douglas—when the DC-8 entered service and there had been good co-operation from other DC-8 operators when coping with initial introduction and teething-trouble problems. A nucleus of four captains and four flight engineers was trained at Douglas; thereafter the training programme has been continued at Schiphol.

Pilot Indoctrination

Flight-crew preparations for the turbojets started during 1954, when, as already explained, selected captains were brought in on the "paper jet" studies. Developing from a flight-planning exercise, the studies became a valuable means of pilot conditioning and indoctrination; they continued until 1959 and all K.L.M.'s captains eventually played a part in this work.

The pilot would be asked to prepare a flight plan based on, say, a month-old weather forecast for the North Atlantic crossing. Then the actual weather and winds over the chosen track and altitudes of the flight, with the known terminal and alternate conditions, would be provided piecemeal as these would normally have become available to the pilot during a crossing, and he would be left to reach his own conclusions and to make his own decisions. Similarly, engine or pressurization failures might sometimes be assumed at a certain stage in the flight and new decisions would need to be made quickly on a basis of the changed flight conditions.

No doubt one or two of the "paper aeroplanes" were lost during these operations, but the experience will have been invaluable. When the time came for real-life flight-planning and operations, the trainees were already thinking in the way in which a turbojet pilot must think—always, so far as possible, a jump ahead of prospective events.

This same habit of constant anticipation applies, in a different way, to the physical handling of the turbojet. Although the DC-8 may be, as its pilots say, both pleasant to fly and without any inherently difficult qualities unless it is roughly treated, it is, nevertheless, a heavy, swept-wing turbojet and must be handled accordingly. Pilots are encouraged to forget everything they have previously learned and to remember that success depends on rapid-fire, predetermined action during take-off and initial climb, and on really accurate flying, with absolute speed control, during circuit, approach and flare-out.

Changes in Technique

The fundamental difference between the old and the new techniques might be explained by saying that the turbojet is handled on the approach with a constant attitude but variable thrust, whereas the big propeller-driven aeroplanes are usually flown with a constant thrust but a variable attitude. The turbojet, in fact, takes the pilot back to the earlier era when he was in immediate and sole charge of the power and trim—a situation which (when speed must be controlled to within a couple of knots or less, and when thrust does not immediately produce dividends in the way of lift and acceleration) puts the pilot on his mettle. This, perhaps, is one of the unspoken reasons why the big turbojets are liked by flight crews.

Even on the first local training flight the operation of the turbojet must—because of its high performance and by the nature of the existing A.T.C. environment—be handled briskly and professionally. Gone are the days when it was possible to loiter on the apron or at the end of the runway for a conversational run through the drills and plans; and, once rolling, the turbojet leaves its pilot no time for second thoughts.

Apart from the earlier "paper jet" studies and 170 hours' technical instruction (including work on flight techniques and flight planning) the K.L.M. trainee captain will have completed a 25-hour jet indoctrination course on turbine engine and aerodynamic fundamentals and 36 hours in the simulator before he walks out across the apron for his first instructional flight in the DC-8. Unless he has previously been line-flying DC-7Cs or Viscount 803s (both of which carry the equipment) he will also have been given a 15-hour indoctrination and simulator course on the Sperry Integrated Instrument System.

So he will be fairly well briefed and the first flight is likely to be a professionally planned and competently executed operation. Even so, he will afterwards put in some 14-15 hours

of local flying at all levels, including 40-50 take-offs and landings, before he obtains his type rating and is ready for route experience.

Although the load on the flight crew of a turbojet is fairly heavy and constant, the K.L.M. instructors are careful to see that the ab initio pupils (if experienced line pilots can be so described) are not pressed too hard in the early stages of training. Such pressure during, for instance, initial flight-deck familiarization in the DC-8 simulator, might harass and even frighten the newcomer. He is, therefore, left to find his own way about until such a time as he is thoroughly accustomed to the drill. Necessary pressure is then gradually applied so that the prospective DC-8 pilot gets into the habit of making quick and clear decisions in advance of the event and of taking calm and correct action. When working in the navigational trainer classroom, for instance, the procedures are steadily accelerated and the clock is physically speeded up.

The checks which are given later to line captains every two months on the simulator are especially intensive. Over a four-hour period the pilots (changing rôles from captain to first officer and back again) are given a succession of problems, emergency situations and synthetic failures of all kinds.

So far, the K.L.M. instructors seem to have found no noticeable difference in the performance of pilots of different ages. No doubt some of the older pilots find the work harder, but enjoy the compensating advantage of greater experience. The primary requirement for the turbojet pilot is mental flexibility.

Apart from the problems posed by the need, with a relatively small fleet, to fit flight training into the pattern of normal operations and maintenance, there are inevitable local difficulties when using a busy airport such as Schiphol—which has, too, its community relations difficulties in terms of jet noise at night. It is possible to use Groningen for touch-and-go landings, but not, with its short runway, for actual take-offs and landings. Ideally, flight training would best be completed at a distant airport such as Stockholm's Arlanda, which is well away from built-up areas and not too busy, but such a plan would cause the aircraft to be out of line service for several days—and this is not often possible.

Flight training is, from the start, worked on a line discipline basis. Not only is this necessary for indoctrination reasons, but it is the only practical system when every flight with a big turbojet is, in fact, a full-scale operation in a natural A.T.C./airway environment.

K.L.M. now has five synthetic trainers. Four of them are simulators—for the DC-8, the Electra, the DC-7C (which is averaging 16 hr. a day utilization and has now completed more than 21,000 hr.) and the Viscount—and the fifth is laid out for general procedural practice and training in navigation, pattern-flying and let-downs for different areas and airports.

The deadly serious business of training is lightened by the use of an ingenious and pointful set of names for each. The DC-7C and Electra fleets are named respectively after seas and heavenly bodies; what more fitting names for the associated simulators could there be than "Dry Sea" and "Terra"? The DC-8 is named "Baron von Münchhausen" (who told very tall travellers' tales without actually going anywhere); the Viscount is named "Van Speyk" (after the Dutch admiral who said, when told to surrender, that he would "rather go up in the air" and put a match to the ship's powder magazine); and the procedural trainer is simply "Lokeend," or "Decoy Duck."

Operational Methods

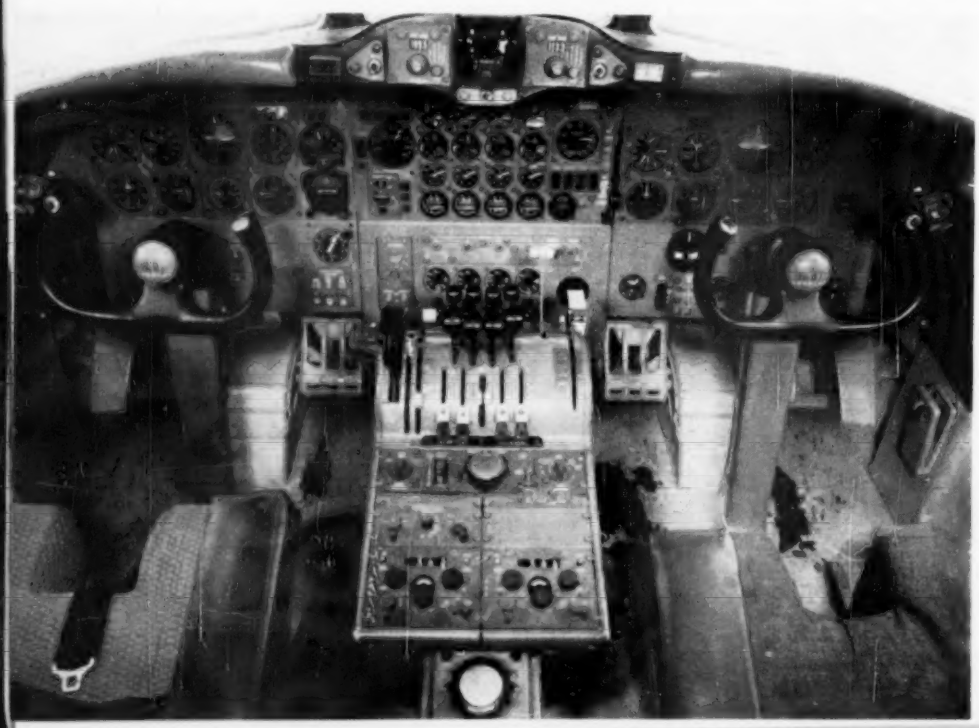
K.L.M.'s operations department has developed an interesting type of working flight-plan which is an ingenious combination of graphical and tabular presentation. The main part of the single sheet consists of an easily translated plot of estimated progress and expected fuel consumption based on co-ordinates of fuel/flight-time and distance and including a detailed plot of alternate, reserve and holding fuel. On this chart the actual ("howgozit") results can be re-plotted and the lines extended to give the reserve and alternate fuel situation at any moment during the flight.

At the foot of the sheet is a detailed tabulated flight-plan related to the graph and on the left is space for appropriate performance curves. The graphical part of the plan is normally used and amended by the navigator, while the tabulation is kept by the captain. The standard flight-deck crew of a K.L.M. DC-8 on the North Atlantic consists of two pilots, a pilot/navigator and a flight engineer (usually accompanied by a supernumerary).

For long-haul turbojet operations the fuel reserves may seem to be small as a proportion of the total carried—and small, too, in terms of airborne time—by comparison with those to which pilots were accustomed in the piston-engined era. But the turbojets are operated to a much more accurate flight programme and the reserves will be properly used.

On the North Atlantic service the take-off fuel includes 4% for contingencies, and allowances for 20 min. holding over destination, for diversion to the selected alternate and for two approaches there; beyond this there is a specified minimum amount in the tanks upon landing, which is, in effect, a final emergency reserve. If payload permits, an additional amount of 3,000 kg. (± ½ hour) "regularity reserve" is carried. The holding fuel and the "fuel over alternate" will amount to the equivalent of about an hour's flying—but the point is that the turbojet captain will just not get himself into a position in which these reserves are really needed. The extra "regularity fuel," which is carried if payload permits, does just what its name implies by allowing longer holding over destination to await, for instance, a weather improvement.

The DC-8 is a heavily loaded, high-speed, swept-wing aircraft and K.L.M. does not pretend that it has overall characterstics other than those associated with this formula. But its handling, especially on the approach, is good and divergent Dutch roll has to be actively demonstrated by the rough use of the controls. The leading-edge slots (inboard of the wing-pylon intersections and covered by doors in normal cruising flight) help to give a lower take-off rotation speed and better low-speed characteristics generally—but the principal reasons for the good handling in the circuit and on the approach seem to be the relatively modest sweep-back, coupled with the



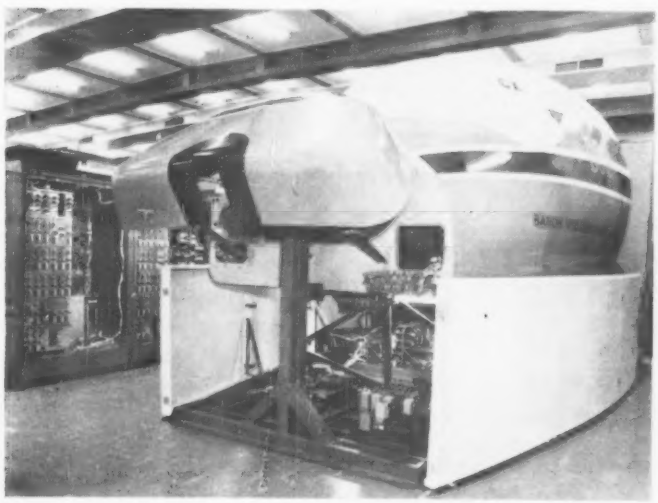
The cockpit of the DC-8 is not only tidy, but relatively simple by earlier transport aircraft standards. Nevertheless, K.L.M.'s turbojet pilots complete 36 hours in a DC-8 simulator before starting on base training.

Three of K.L.M.'s initial batch of seven DC-8s can be seen in this view of the busy apron at Schiphol Airport, Amsterdam.

"inverted aerofoil" philosophy of the wing design, which causes the centre-section to stall early, and good fin effectiveness. The DC-8 is probably the only high-speed aircraft for which there has, at least so far, been no requirement for the use of vortex generators.

The ultimate range/payload performance of the current long-haul DC-8 is down on guarantees, but this does not appear to have affected K.L.M.'s operations to any appreciable extent. Modification to the leading edge, involving a 4% increase in chord (see our issue of Nov. 25), will reduce the drag and improve the range by 7%.

The five additional turbofan aircraft could have had this change incorporated before delivery at the cost of a two-month



The DC-8 simulator seen here is one of five synthetic trainers used by K.L.M. Four are "type" trainers; the fifth is used for general navigation and procedural work.

delay. K.L.M. prefers to have these aircraft on time (from May, 1961) and will undertake the modifications in its own engineering shops during the 1961-62 winter period. The first three of the initial batch of seven aircraft were delivered without the inner leading edge fuel tanks and with JT4A-3 powerplants. K.L.M. completed the modifications to these aircraft and will also do the work on the wing structure and undercarriage of all seven aircraft to permit the weight to be increased from the present 310,000 lb. to 315,000 lb.

By prior arrangement, the JT4A-3 powerplants (15,800 lb. s.t.) in the early series of aircraft have now been replaced by JT4A-9s (16,800 lb.) and two JT4A-11s (17,500 lb.) are already installed and flying as part of a programme involving the re-engining of the initial fleet of seven to the -11 standard with consequently useful increases in cruising as well as take-off power.

The five turbofan DC-8s (with JT3D-1s of 18,000 lb. s.t.) will offer an overall reduction of fuel consumption of 7% with 12,000 lb. more payload, or an overall reduction of 14% with present payload. These Series 50s will be used primarily for the long-haul Polar (Amsterdam-Anchorage-Tokyo-Biak) and mid-Atlantic (Amsterdam-Lisbon-Curaçao) services. According to fleet availability they will also be used on the North Atlantic run—and specifically, no doubt, when weather conditions demand the best possible range/payload performance.

The Series 30s started their operating life on the North Atlantic service last May and, as the fleet and crew strengths were built up, were introduced successively on the east-about Tokyo run (Nov. 15) and on the service to Biak and Sydney (Nov. 18); they are due to start to operate to Singapore on Jan. 9.

Operating techniques with the turbofan Series 50s will not be appreciably unlike those for the Series 30 and the cruising performance will be similar. On take-off, because of the increased drag of the bigger turbofan pods and the higher thrust, the minimum control speed will almost certainly be increased, with changes in V_1, V_R and V_2 values. It will be interesting to see whether the computers of the standard DC-8 simulator can be re-programmed so that Series 30 or 50 performance and characteristics can be made available at the flick of a switch.

The changing pattern of passenger demand is shown by the economy/first-class seating ratio for K.L.M.'s DC-8s. This year the layout was arranged, on the North Atlantic service, for 93 economy-class and 24 first-class passengers. In 1961 the ratio will be changed to 96/20 and during the peak travel season it will be 108/16.

There are a number of important detail developments in connection with the DC-8 operations. A computer designed to feed Doppler-derived co-ordinates into the auto-pilot system has been under test in a DC-7C and is now installed in the DC-8. A.T.C. transponders have now been fitted in four of the DC-8s. A full flight-recorder system is on trial in co-operation with the Netherlands aeronautical research institute and the first meteorological teleprinter receiver will be fitted shortly.

The future? K.L.M. has a supersonic transport study group and will be well prepared for the next major re-equipment decision—though, like the majority of airlines, it will no doubt continue to hope that this decision can be delayed for as long as possible.

A less distant prospect may be the introduction of turbofan DC-8 freighters on the North Atlantic and other heavy-traffic long-haul routes. The use of such an aircraft for specialized freight work makes sense in the case of an operator which already has a fleet of similar passenger-carrying aircraft. The turbofan freighter may not, as such, be more economical to operate than a propeller-driven aircraft with a similar capacity —but it is likely to be so when crew training and engineering costs are taken into account.

Such a high-speed freighter has one outstanding advantage so far as the North Atlantic is concerned: it can make the return trip and be serviced and turned round within a 24-hour period. There will be no lost half-days, and a high utilization will be possible within the framework of the conventional timings for load availability and delivery.

Storable Propellents

By Dennis Carton and R. W. Stutchbury *

ALTHOUGH the time-honoured division in rocket propellents is between solids and liquids, at the present moment a further division is becoming apparent. This separates the liquid propellents into groups: those which, at room conditions, are "normally liquid" (give or take a little) as distinct from those which are "normally gas" at room conditions (fugitive or cryogenic in the liquid phase).

Separate compounds of the "normally liquid" group are described as "storable propellents." The title is rather pseudonymic in that the definition ignores problems of human hazard, corrosion and catalysis.

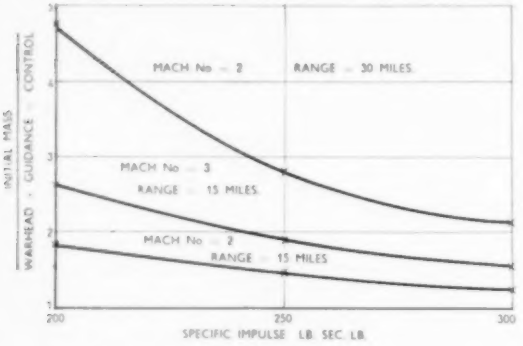

INITIAL MASS
WARHEAD + GUIDANCE + CONTROL
MACH No = 2
RANGE = 30 MILES
MACH No = 3
RANGE = 15 MILES
MACH No = 2
RANGE = 15 MILES
SPECIFIC IMPULSE LB. SEC. LB.

Fig. 1. Cruise vehicle size/performance.

Right throughout the rocket field there exists real boundaries to use because of operational limitations of both solid and cryogenic propellents. In the discussion that follows operational problems highlighting their variety are examined, some of which may be eased by the use of "storable propellents." It is necessary to emphasize that, because of the wide variety of the boundaries that exist, there is no one ideal, or even best, "storable propellent" combination.

Weapon Propulsion

In the case of supersonic weapon-carrying aircraft, continuous exposure to the flight environment leads to severe problems. Solid propellent motors do not take kindly to being steadily heated from the case inward.

With small, low-cost, air-to-air weapons the saturation technique can also be allowed to absorb a further source of unreliability due to this aerodynamic heating. But with quality weapons, where reliability needs to be kept high, a weapon propulsion system impervious to the heating problem would be a boon.

An obvious solution to the problem is to remove the weapon from the heat source by enclosing it within the carrier aircraft. But with increasing flight Mach numbers and cruise duration the solution is of limited application. Now, not only is the heating a problem but with enclosure within the carrier vehicle, propellent density also becomes an important factor.

The importance of specific impulse, and its effect on weapon size, and the reflection back onto the carrier is shown in Figure 1. Here a ratio of initial mass to "payload" mass is plotted against specific impulse for various cruise Mach numbers and ranges. This shows how weapon size increases considerably with speed, and how this effect can be reduced by raising the specific impulse.

Surface-launched Tactical Weapons

There is a range of problems here in many ways analagous to the airborne weapon problem, but with different requirements. The reliability and performance of solid propellent boosters, and sustainers are detrimentally affected by exposing them to the vagaries of climatic temperature across the Earth. The possibility of manufacturing a system which after leaving the factory would have a constant reliability and performance from the Indus to the Andes obviously has considerable attraction.

Ground-launched Strategic Weapons

Part of the United States policy deterrent theory requires that some of the ICBM group should be available for launch on demand with a count-down reduced to a severe minimum. This involves the need for the weapon to stand "loaded" with propellent during a stand-by period.

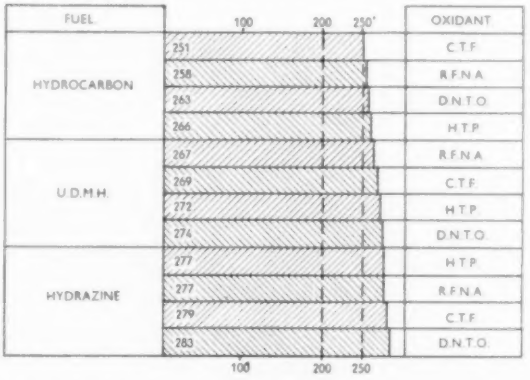


Table 2. Mass flow specific impulse (lbs. sec./lb.) Isentropic performance, frozen equilibrium for P_c=1000 lb./in² and Pe=14.7 (derived from Rocketdyne Chart 505-X).

At the present time this is producing a "storable propellent" demand which cannot yet be met (at 5,000 miles + range) by solid propellents. This demand is probably transient and will be satisfied by one of the large solid propellent ICBMs nearing the end of its development phase in the United States.

Satellite Applications

Multi-stage launchers for satellites and other payloads do not call for replacement of first-stage liquid oxygen/kerosene propulsion. However, short storage times for second or third stages may produce a "storable propellent" application. The final selection of a propellent combination for a second stage would depend considerably on propellent performance, to a lesser degree on propellent density, and very largely on reliability

Table 1 lists the "storable propellents," and some of their properties, in particular those which have an effect on their storability. Only three fuels are offered, and four oxidants. All of these have been in use in the United States, but only

TABLE 1. STORABLE PROPELLENTS : PROPERTIES

	Freezing Point C	Boiling Point C	Density lb/ft³	Toxicity	Corrosiveness	Monopropellent Catalysis
		Final				
Hydrocarbon	−40	+270	49	Mild	Nil	Nil
U.D.M.H.	−57	+63	49	Bad	Steel O.K.	Nil
Hydrazine	+2	+114	63	Very Bad	Stainless O.K.	Fair
H.T.P.	−6	+148	89	Nil *	Aluminium or Stainless O.K.	Good
R.F.N.A.	−56	+61	97	Bad	Aluminium or Stainless O.K.	Nil
D.N.T.O.	−11	+21	89	Very Bad	Dry—Steel O.K. Wet—Bad	Nil
C.T.F.	−83	+11	115	Very Bad	Very Bad with Organics	Nil

* H.T.P. is non-toxic, but contact with skin (particularly eyes) causes strong irritation and blistering.

Hydrocarbon	:	Approx. CH_2 D.Eng.R.D. 2495 (Fuel: Rocket engines : Kerosene type)
U.D.M.H.	:	$(CH_3)_2$ NNH_2 Unsymmetrical dimethyl-hydrazine
Hydrazine	:	N_2H_4
H.T.P.	:	High Test Peroxide (in these tables 95% H_2O_2 (Hydrogen peroxide) with water)
R.F.N.A.	:	Red Fuming Nitric Acid (in these tables 85% HNO_3 + NO_2)
D.N.T.O.	:	N_2O_4 : Dinitrogen tetroxide (also Nitrogen Tetroxide)
C.T.F.	:	ClF_3 : Chlorine trifluoride

* Department of Aircraft Propulsion, College of Aeronautics, Cranfield.

kerosene, H.T.P. and R.F.N.A. have received any public acclaim in the U.K. Kerosene is the cheapest fuel by a factor of 10, and R.F.N.A. is the cheapest oxidant by a factor of 3 to D.N.T.O. and 6 to H.T.P.

Table 2 lists the performances of the "storables" in terms of mass-flow-rate specific impulse. This shows—on the fuel side—an interesting regularity and indicates the cost of achieving high specific impulse. In spite of the small gain—of only 32 units—from worst to best, reference back to Figure 1 will indicate the size/performance sensitivity experienced with cruise vehicles.

Table 3 lists the volume flow rate specific impulse in lb. sec/0.01 cu. ft. units. In this, the order of Table 2 is lost, except that chlorine trifluoride now shows an overwhelming advantage over all the other oxidants. This is the more remarkable as C.T.F./hydrocarbon had the poorest performance on Table 2.

Actually, Tables 2 and 3 together underline a difficulty—just how important is propellent density? On certain occasions it is of equal effect with specific impulse, but more normally there is a rather complicated relationship involving vehicle size and duty.

A number of interesting applications of propulsion exist where storage times of days, months, or even years may be required. An example of a "storable propellent" job with a short storage time will be the landing of instrument packages fairly gently on the surface of the Moon (Ref. 1).

More extended storage times may arise for satellites which require a close control of both orbit and attitude over perhaps a period of a year. An example is to be found in Hilton's communication satellite (Ref. 2).

FUEL	LB. SEC. / 01 FT³ 100 200 250	OXIDANT
U.D.M.H.	199	D.N.T.O.
HYDROCARBON	204	D.N.T.O.
U.D.M.H.	208	R.F.N.A.
U.D.M.H.	209	H.T.P.
HYDRAZINE	214	D.N.T.O.
HYDROCARBON	215	R.F.N.A.
HYDROCARBON	215	H.T.P.
HYDRAZINE	217	H.T.P.
HYDRAZINE	219	R.F.N.A.
HYDROCARBON	222	C.T.F.
U.D.M.H.	232	C.T.F.
HYDRAZINE	262	C.T.F.
	100 200 250	

Table 3. Volume flow specific impulse (lb. sec./cu. ft.). Isentropic performance, frozen equilibrium for P_c=1,000 lb./in² and P_e=14.7 (derived from Rocketdyne Chart 505-X).

References

(1) Gatland, K. W., "The Robot Explorers," *Spaceflight*, July, 1960.

(2) Hilton, W. F., "A Projected Communications Satellite," THE AEROPLANE AND ASTRONAUTICS, Aug. 12, 1960, pp. 182-184.

Bomarc News

ALTHOUGH deliveries of production-model Boeing IM-99B Bomarcs to the U.S.A.F. have now begun, several hundred of the earlier IM-99As remain to be built. On a recent visit to the Missile Production Center in Seattle, we saw both types undergoing assembly and testing.

Most significant of the differences between the Bomarc A and Bomarc B is the change from an Aerojet General LR59-AJ-13 liquid-fuel rocket booster in the afterbody to a Thiokol Chemical Corp. solid propellent booster. This change, and a small increase in length, allows Bomarc B to carry more fuel (80 octane petrol) for its externally mounted Marquardt ramjets and doubles the operational range. Another change is from the batteries in the A to a liquid-fuel powerplant in the B as a source of power for the electronics.

Final assembly and testing occupies one of the two 800-ft. long buildings of the Missile Production Center, which Boeing has occupied for the past two years. Since there is no equipment or system redundancy of any kind in the Bomarc, testing naturally occupies a major place throughout the assembly sequence, and is broken down into a number of distinct phases.

At the earliest level, tests are conducted on individual components—resistors, switches, valves and so on. Sub-assemblies which, when incorporated in the finished missile, are difficult of access, are tested next, the following stage being tests on major assemblies, including the electronic packages and hydraulic power pack.

The penultimate stage of testing checks out the missile's systems, including the electronic target seeker (three components checked together), the hydraulics, pneumatics, mechanical systems and boost system. Finally comes the test of the total missile, in which it is functioned as a single entity for the first time.

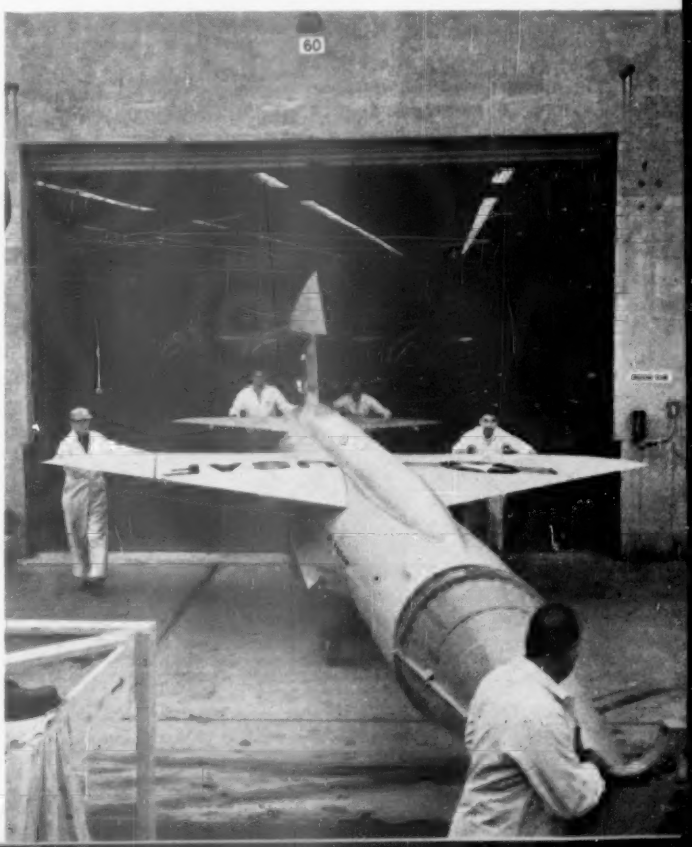
For this functional check-out (FCO) a set of equipment has been developed which will carry out the 147 test steps automatically in sequence, or under manual control. The missile is cradled on an air-cushion for this testing and is allowed to tilt and roll within limits to check the functioning of the controls.

The FCO equipment is self-checking for the first 42 steps of the test, which are concerned with such items as signal generation and power levels. Thereafter, the test is principally concerned with the missile's response to command signals for roll, pitch and yaw movements and the working of the flight instruments.

On average, 10 to 12 trials are needed for each missile before a satisfactory test result is obtained. Similar FCO equipment is maintained at Bomarc bases and can be taken to the shelters for *in situ* testing; at regular intervals, Bomarcs are returned to Boeing for a complete strip and overhaul.

Production rates of both the A and the B are adjusted to suit base availability. IM-99As are operational at five bases in the north-east U.S., and new bases will be established for the B model, which has recently been reinstated as a full production type after an earlier cut-back in procurement.

Bases for IM-99Bs are also being built by the Canadian Government in Ontario and Quebec. Canadair, Ltd., is now building all wings and ailerons for Bomarcs, whether destined for the U.S.A.F. or the R.C.A.F.—F.G.S.



First production Model B Bomarc is rolled out from the Boeing factory in Seattle, Washington.

Ionosphere Satellite S-51

HEADLINES in the national Press on Dec. 16 may have given the impression that this country was at last moving into high gear in satellite development. A typical headline ran: "British Satellite Launching in One Year." In fact, the news was no more than that formal agreement had been reached to launch some 20 lb. of British-built research instruments in an American-engineered satellite, to be launched in the United States by an American launching vehicle. Details of the arrangements will long have been familiar to readers of this journal.

The first U.K./U.S. satellite, known officially as Ionosphere Satellite S-51, is scheduled to be launched from the NASA test site at Wallops Island, Virginia, by means of a four-stage Chance Vought Scout. Construction and testing of prototypes are under way and will be followed in due course by the construction and testing of flight models.

Spin-stabilized, the satellite will be roughly spherical, nearly 24 in. diameter, with four telemetry antennæ transmitting in the 136-137 Mc/s. band. It will have facilities for tape-storing information in orbit. One command centre for receiving data from the satellite will be at the Radio Research Station, Slough, Bucks.

Several watts of electrical power will be generated by four solar-cell "paddles" extending from the satellite after the fashion of those used in the solar probe Pioneer V; these will recharge chemical batteries. The satellite is intended to remain in working order for a year, whereupon its radio transmitter will be switched off to clear the waveband for further experiments.

Satellite casing, telemetry system, tape-recorder, and power supplies, are all of American design and construction. Scientific instruments designed and made in Great Britain by various university departments, in conjunction with certain elements of the electronics industry, are being mounted in appropriate positions in the satellite. The experiments themselves were described in THE AEROPLANE AND ASTRONAUTICS, Sept. 9, 1960, p. 338.

The sensor electrodes of the Birmingham University electron density experiment will be carried on a boom which will swing out radially from the satellite after launching. Another boom will carry a probe electrode for one of the experiments of University College, London. The cosmic ray detector, designed at Imperial College, London, will be mounted on the satellite's spin axis immediately behind the spherical detector of the University College ion mass spectrometer.

It is proposed to launch the S-51 satellite at an angle of about 50° to the Equator so that at times it will pass over southern England. Perigee and apogee of the orbit may vary between 200 and 600 miles.

Cosmic Rays and Soviet Rockets

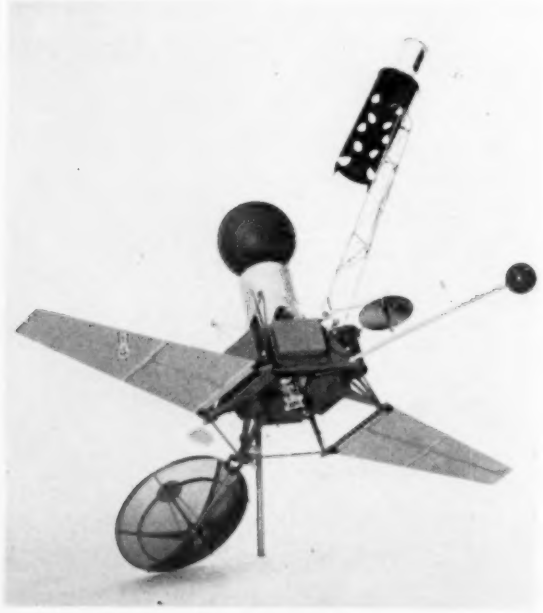
SOVIET scientists have developed a technical competence in utilizing rockets and artificial satellites in cosmic ray research, which may attain for them a lead over the West in the study of the effects of cosmic radiation on life in outer space, but they are 5-10 years behind the West in certain aspects of experimental cosmic ray physics. This is the general conclusion reached in an analysis of available information on Russian research in cosmic ray physics released through the Office of Technical Services, Business and Defense Services Administration, U.S. Department of Commerce.

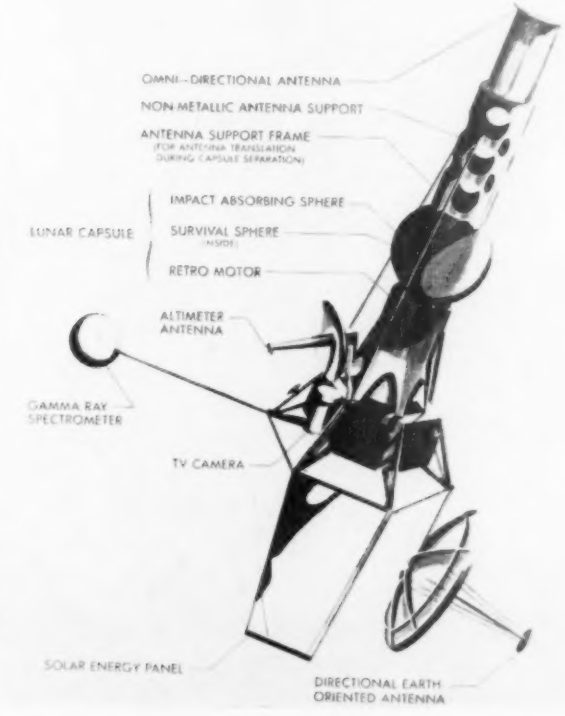
The report states that the Soviet work does not have the breadth, flexibility, and imagination of Western efforts in this field. While the Russians have made important contributions, their work has added significantly less than that of Western scientists to the overall progress in cosmic ray physics.

Nevertheless, the report recognizes the likelihood of a Soviet lead over the West in the study of the effects of cosmic rays on organisms. Russia has had available rocket vehicles and effective propulsion systems which have enabled them to use animals to test life-sustaining systems in space and under space-equivalent conditions to a greater degree than have the scientists in other countries.

As regards their other work, Soviet theoretical study of the origin and variations of cosmic rays is reported as "notable." By far the most outstanding and influential of their contributions in this field is the relating of astrophysical and cosmic ray observations to each other. The Russians are also devoting much study to the theory of extensive air showers and the interactions of cosmic rays with matter.

Prof. A. Blagonravov has emphasized that the Earth's magnetic field reflects and traps a large number of cosmic particles. It is therefore necessary, he says, to fire research rockets beyond the Earth's magnetic field as well as beyond the atmosphere.





MOON MISSION.—Latest configuration of the Ranger spacecraft RA-3, RA-4 and RA-5, now being developed by the Jet Propulsion Laboratory for "rough-landing" instruments on the Moon. Lunar capsule, complete with retro-rocket, instruments and balsa protective sphere, is designed to separate within 20 miles of the Moon's surface.

Personal Flying

ANOTHER plea for better facilities for business aircraft in the U.K. was recently made by Mr. Geoffrey Woods, chairman of Woods of Colchester, Ltd. He was speaking during a brief ceremony to mark delivery of the first British-registered Aero Commander, which he accepted from Mr. H. S. Carpenter, sales manager of Field Aircraft Services, Ltd., the U.K. agents.

The 500B Commander was handed over at Wormingford, one of the many disused wartime airfields around Colchester, which has no official airport. These abandoned aerodromes, most of which have excellent runways, are not available for aircraft use except by special arrangement, and, of course, have no facilities as they stand. Wormingford has a good hangar, which at present is empty, but is to be pulled down before the airfield is returned by the Air Ministry to its pre-War owner from whom the land was compulsorily requisitioned. Woods' Commander is based at Boxted, on the other side of Colchester, where there are no hangars.

Fortunately, the Mayor of Colchester, who was present at the ceremony, together with Mr. Clive Hunting, a director of Fields, is taking an interest in the airport problem, and some favourable developments seem likely. Mr. Woods pointed out that there were 220 operational airfields in the U.K., and a further 266 disused strips for which there was an urgent need.

On the basis of population, there ought to be some 17,000 aircraft in Britain, compared with the 65,000 plus in the United States. Of the 510 business and private aircraft on the British Register, about 80% were between 12-22 years old. France had 350 light aircraft based at Toussus-le-Noble alone. S. Africa had 590 light and executive machines.

After detailing the many examples of time-saving made possible between his Colchester headquarters and the 27 centres in Britain served by his company, by light aircraft, Mr. Woods went on to mention that his previous executive aeroplane, a four-seat Beech Travel-Air, had flown 760 hours in 12-13 months of effective operation. Its replacement, the Aero Commander, could seat up to seven persons, or the rear seats could be removed to permit up to 1,800 lb. of freight to be carried over short distances.

• • •

So far, India has two major aircraft manufacturing centres: I.A.F. Maintenance Command and Hindustan Aircraft, Ltd. The latter is the largest aircraft organization in the East today and was founded in 1940. It is well known for its overhaul and repair of various military and commercial aircraft and engines, and more recently for the design and manufacture of the HT-2 trainer, plus licensed construction and assembly of the D.H. Vampire, the Folland Gnat and the Bristol Orpheus turbojet.

To meet Indian civil requirements for a light aircraft, HAL has designed and developed the two-seat Pushpak for flying clubs and similar use. The Pushpak is of composite construction, the wings having metal spars and ribs with a leading-edge of aluminium alloy sheet and steel tube tips with fabric covering. Fuselage is of welded seamless steel tube construction, cross-sections being formed by wooden bulkheads, and the tail is entirely of tubular construction, all covered with fabric.

Its undercarriage is an orthodox fixed type and utilizes HAL-designed coil and oil shock absorbers, plus a steerable tailwheel. Seating of the Pushpak is side by side, and the powerplant is a 90 b.h.p. Continental.

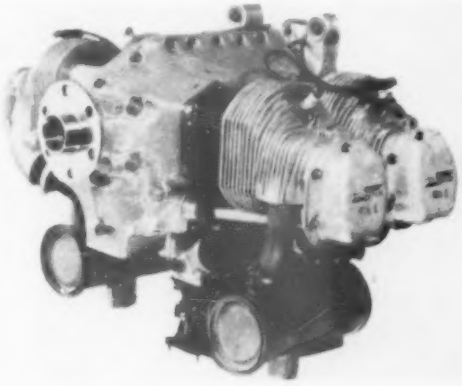
The Pushpak was constructed in a record time of six weeks, the prototype making its initial flight in September, 1958. Since then 30 aircraft have been sold and many more are on order. Price is the equivalent of £1,650 in India.

Top speed of the Pushpak is 90 m.p.h.; cruising speed, 80 m.p.h.; rate of climb, 500 ft./min.; range, 250 miles; service ceiling, 14,000 ft.; absolute ceiling, 15,400 ft.; empty weight, 870 lb.; useful load, 480 lb.; gross weight, 1,350 lb.; wing span, 36 ft.; length, 21 ft.; and height, 9 ft. 1 in.

A four-seat development of the Pushpak is the Krishak, which is intended for observation, ambulance and agricultural spraying/dusting operations. It is of similar construction to the Pushpak and features STOL capabilities. It is powered by a 190 b.h.p. Continental engine and is stressed for a load factor of 3.8. Performance figures are being withheld pending completion of flight testing.

When the Pushpak was first produced, HAL decided to develop and manufacture a suitable engine for it. The result was the PE-95 Mk. 1 flat-four, developing 90 b.h.p. It was designed, built and run in a period of 4½ months.

Conventional and time-proven methods were employed throughout in the development and construction of all components. To avoid reduction gearing and its attendant complications, the maximum take-off r.p.m. was fixed at 2,600, with a compression ratio of 6.7, which allows the use of normal octane fuel available in India and other Eastern countries.



Indian progress in the lightplane field is illustrated by these photographs of the two-seat Pushpak and the four-seat Krishak, (below left and bottom left), and the 90 b.h.p. PE-95 Mk. 1 engine (above), all produced by Hindustan Aircraft, Ltd.

About 95% of the new HAL engine is manufactured in India, and the company also hopes to build the carburetters and magnetos, at present imported, in the near future. HAL reports that preliminary assessment of this new powerplant has proven encouraging and development is continuing. A larger engine to power the Krishak is also under consideration.

• • •

A new concept of basic flight instruction is being tested by the U.S. Army at its Aviation Centre at Fort Rucker, Ala., on 16 new Cessna 180s, which are on lease for this programme. The new system, which is code-named INTACT (Integrated Instrument Contact Primary Flight Training) is based on earlier research by the Boeing School of Aeronautics, the University of Illinois and the University of West Virginia.

Its method is to combine visual flight techniques with basic instrument flying during initial training, instead of the normal system of learning to fly by visual reference to the ground before transferring to instrument techniques. The object of the new integrated training is to teach the importance of making both visual and instrument techniques part of normal procedures.

Old and new training methods will be evaluated by comparing the progress and proficiency of students from two primary classes between January and September, 1961. Some will receive integrated training on the Cessna 180s, others will received non-integrated training on similar aircraft, and the remainder will carry on with the normal syllabus on the Cessna L-19. The latter aircraft is generally similar to the Cessna 180 except for its tandem seating.

Personal Flying . . . .

In Seattle last month, THE AEROPLANE AND ASTRONAUTICS had the pleasure of meeting Clayton Scott, a veteran flyer and now Boeing's chief production test pilot at the company's Transport Division, Renton. "Scotty" has formed the Jobmaster Company in Seattle to handle the conversion of Howard DGA15s to floatplanes, and a happy hour was spent flying with him in one of these conversions from Lake Washington, which laps the end of Renton's single long runway. It may not be generally realized that several hundred Howards—the DGA designation is derived from "Dam' Good Airplane"—were built for the U.S. Navy during the War, and over 200 of these are now on the U.S. civil register.

The floatplane conversion, of which about a dozen have been completed so far, is available with five or six seats and full dual control, and has been described as a "poor man's Beaver." Certainly the northwest corner of Washington and the Canadian coast right up to Alaska is ideally suited to floatplane operation, many excellent fishing and hunting areas being easily accessible only in this way. Powered by a 450 h.p. Pratt & Whitney Wasp Junior, the Howard is a good, rugged workhorse for this kind of operation, and thanks to the water rudders on the floats, has good marine manœuvrability.

Also at Renton renewed acquaintance was made with Peter Bowers, well known in the home-building movement and in other connections. Pete was flying his ancient "razorback" Aeronca C.2 off the lake, at the time of our visit, on the Edo floats, reducing this aircraft effectively to a single seater. At the end of the day's flying, Pete elected to put this floatplane down on the grass alongside the control tower—a feat which is, in fact, neither as difficult nor as dangerous as it sounds. It has perhaps not been photographed before, however, so the picture reproduced here, necessarily taken against the rays of the setting sun as the Aeronca touched down, is of particular interest.

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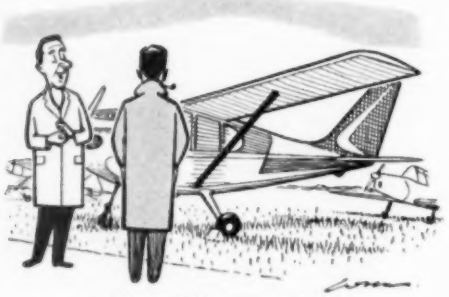

"It's my 1961 status-symbol"

• • •

Following our recent news item on delivery of the first production Wassmer Super IV, we hear from Harold Best-Devereux, who represents Constructions Aeronautiques Wassmer in this country, that several have now been delivered. This four-seater is powered by a 180 b.h.p. Lycoming O-360-A1A engine, and has a tetractable tricycle undercarriage. At 75% power, it cruises at 165 m.p.h. at its rated altitude.

Construction is of steel-tube, for the fuselage, and wooden wings, and Harold Best-Devereux reports that the Super IV is extremely strong and robust, everything being repairable within the abilities of a good club engineer. He says that stalling characteristics are excellent, with a good buffet, and that it is particularly suited for overseas countries. He hopes to bring a demonstrator to this country next spring, and to enter it once more for the R.Ae.C. air touring competition.

FAST FRENCHMAN.—The third production example of the Wassmer Super IV four-seat tourer is seen here on a return visit to its manufacturers.

Photographs copyright "The Aeroplane and Astronautics"

SEATTLE FLOATPLANES.—Top, Peter Bowers lands his "razorback" Aeronca C.2 floatplane on the grass at Renton. Above, the Howard DGA-15 converted for float operations.

• • •

McAlpine Aviation, the Luton-based business flying division of Sir Robert McAlpine and Sons, Ltd., the civil engineers, are increasing their stocks of spares for Piaggio aircraft to the value of £30,000. McAlpine Aviation are the sole U.K. servicing agents for these Italian-built executive twins.

This build-up followed a recent two-weeks visit to the Piaggio organization in Italy by Mr. Ray Young, aviation manager of the company. The growth of executive flying in Britain has increased the demand on the services of McAlpine Aviation, who offer aircraft for sale and hire, and have introduced a comprehensive business flying advisory service. Sir Robert McAlpine and Sons have operated their own fleet of business aircraft for 14 years and have accumulated a wealth of experience in this field.

• • •

A further newcomer to executive flying in this country is Baker Perkins, Ltd., of Peterborough, which has accepted delivery of a Piper Aztec light twin. This is based at Westwood airfield, adjoining the company's offices and works, and is used to fly executives and other staff members around the U.K. and the Continent. It is also available to fly urgent spares to customers' factories.

Its normal schedule is from Peterborough to Leeds, Newcastle, Stoke-on-Trent, Twyford and Luton, where there are subsidiary companies. First assignment, however, was a flight to Germany with the company chairman, Mr. A. I. Baker, the joint managing director and the company secretary. The Aztec can carry four passengers in addition to the pilot, and is fully equipped for all-weather operation.

• • •

Seventy-two members of the Channel Islands Aero Club were guests of the Aero-Club des Cotes du Nord after a lunch patrol to St. Brieuc where the French club has its headquarters, on Dec. 11. Two of the five aircraft from the Channel Islands, an Ercoupe and a DC-3 were spotted, but the others managed to elude interception. During a seven-course lunch in St. Brieuc a cup brought by the C.I. Aero Club for the French pilot who spotted the greatest number of the invaders, was presented to the chief instructor of the Aero-Club des Cotes du Nord, Monsieur Constantin Veyer. A model snail was presented to the chairman of the Channel Islands club, Mr. Peter Hopkinson, by Monsieur Yven Pageot, to commemorate the invasion.

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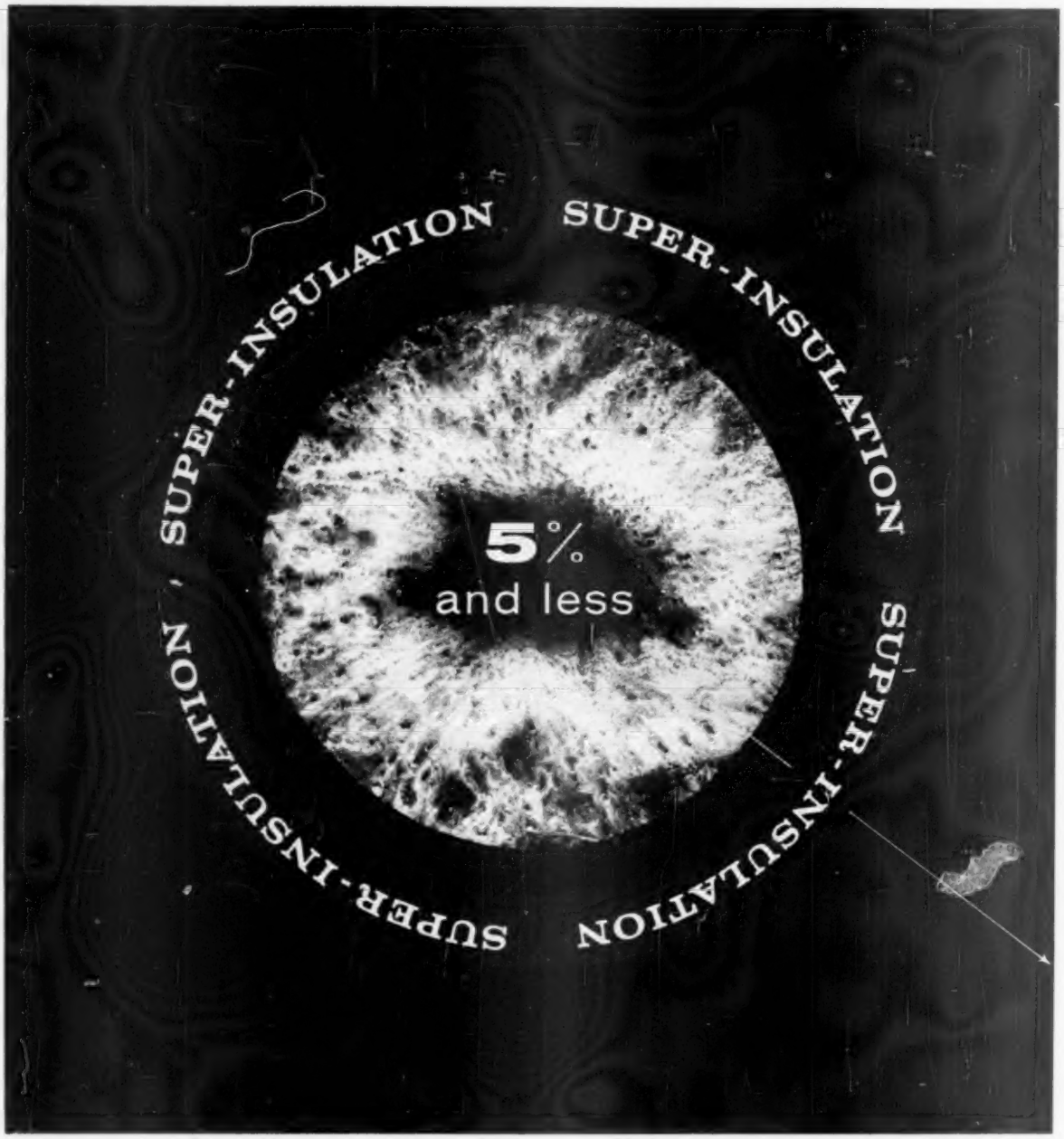

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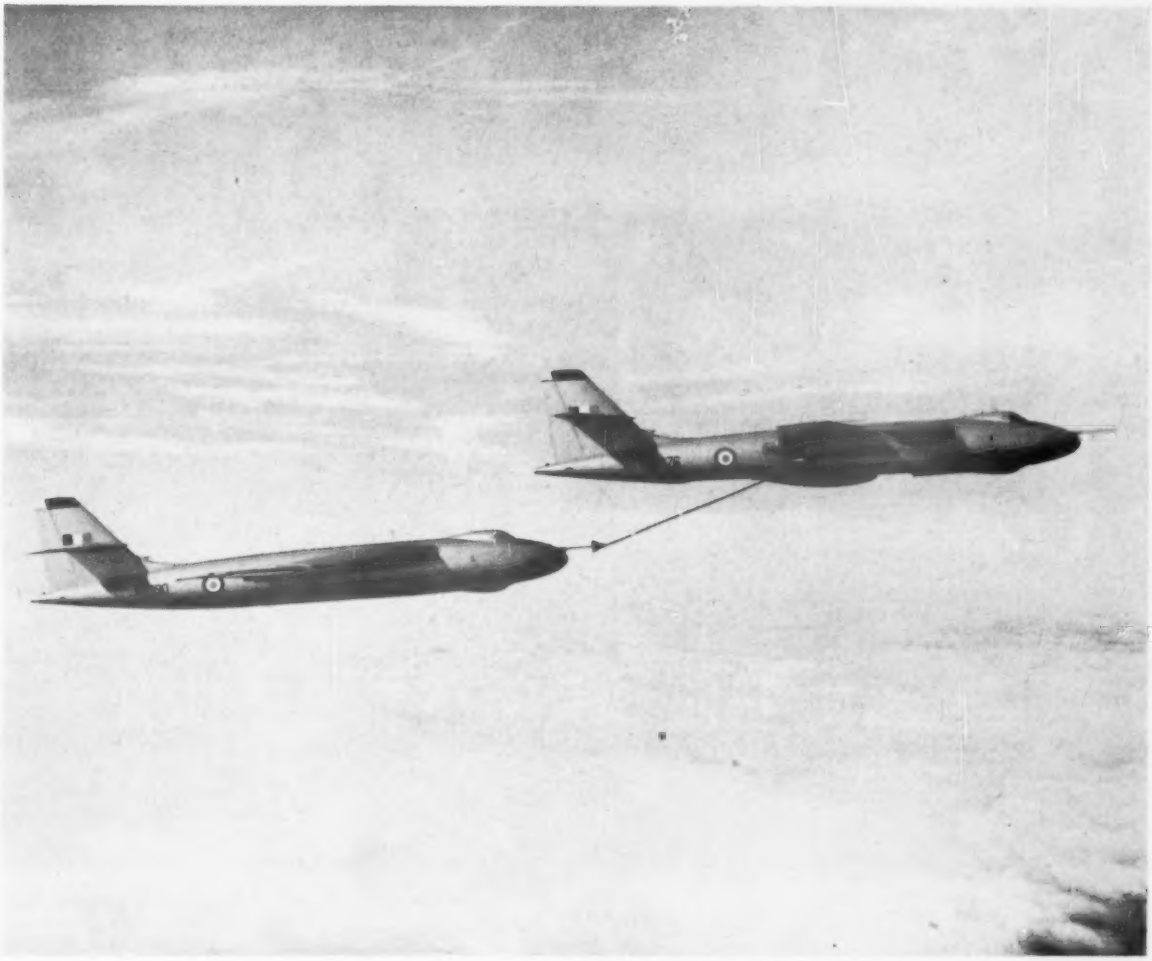

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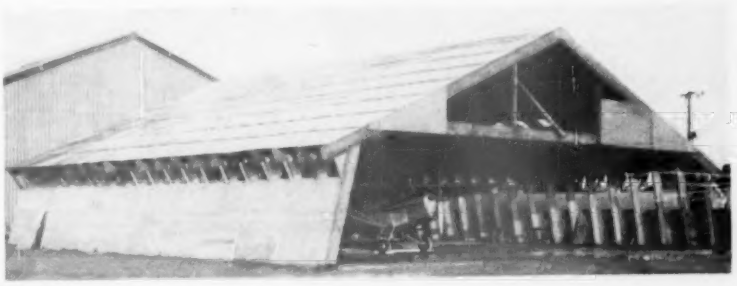
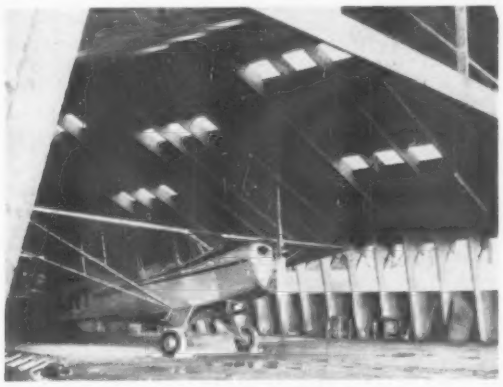
Personal Flying . . . .

Novel Construction for a Hangar

A HOME-MADE hangar of unusual design has just been completed on a Lincolnshire farm; it has a novel method of construction which offers a number of advantages over conventional techniques. It was built by Mr. W. ("Bill") Sturrock, of Lincoln, to house his own Auster aircraft and those of farmers in the area. Mr. Sturrock is both an enthusiastic private aircraft owner and a professional aircraft engineer.

Measuring 50 ft. by 50 ft. the hangar is devoid of interior obstructions and will accommodate four light planes, as well as work benches. The total cost of material, including a 3 in. concrete floor on a hardcore base, was about £600.





The simple wooden structure of this rigid-frame light-aeroplane hangar built in Lincolnshire is shown to advantage in these two views. Its covering is Douglas fir plywood.

The system employed, known as rigid-frame construction, was originated four years ago by engineers of the Plywood Manufacturers Association of British Columbia. Put at its simplest, the building consists of a series of pre-fabricated, full span timber frames, made on the spot and erected along the length of a concrete foundation, the whole structure being clad with exterior-grade Douglas fir plywood, which comes permanently bonded with a waterproof phenolic resin glue.

Mr. Sturrock's interest was first roused when he read about these buildings in an American aviation magazine. Inquiries led him to the Plywood Association of 4 Carmelite Street, London, E.C.4.

The site chosen for the hangar is on the land of a farmer friend, Mr. Alan Troop, at Wellingore, near Lincoln. There is a good deal of private flying in the area, several of Mr. Troop's neighbours having their own Austers.

After comparing the plywood and timber rigid frame technique with other methods of building, Mr. Sturrock chose the Canadian technique for its economy, speed of erection, absence of interior obstructions and relative freedom from condensation. Also, it offered no perching or nesting places for birds.

Persistent wet weather delayed the work, otherwise the whole project would have been completed in a week or less by an unskilled six-man team.

One end of the hangar is clad with ply; the other is being fitted with upward-folding doors. The roof panels, lapped horizontally, are laid shingle-fashion for added strength.

No screws were used in the frame construction which was pinned throughout with galvanized nails. The frames were built out in the open, one on top of the other, with the aid of a simple jig formed by pegs driven into the ground. Screws were used in cladding, to secure plywood lap joints.

In the completed building, these frames rest on a 12-in. by 2-in. timber base which is bolted to the concrete foundation. The frames, in turn, are bolted to the timber base by means of angle brackets.

The building is one of the first plywood rigid-frame type to be erected in Great Britain and has every prospect of an exceptionally long life. Mr. Sturrock plans to protect the wood with a single coat of creosote or similar preservative; but, in any case, Douglas fir plywood is produced to withstand any severe weather conditions.

Gliding Notes

by Dr. A. E. Slater

DERBYSHIRE and Lancashire Gliding Club has produced its first *Newsletter* for a year. It lists 20 cross-country flights from Camphill this year, the longest being 234 miles by D. Elrington to Exeter via Kidlington (Oxford). Brian Jefferson went to Exeter direct, 194 miles. Courses were attended by 89 pupils. Instructors for these courses, it is stated, "have to be more than gliding teachers; they have to be men of parts."

Aero-towing is laid on for club members at Doncaster, 30 miles away, at 15s. per launch. As to financial intake from the public, who are faithful supporters of the club and come out mostly from Sheffield, a sub-committee's plan to increase the annual takings to £1,000 was turned down because any increase in the present public would interfere with the gliding, although the sub-committee claimed that "the greater the numbers of the public, the more obedient they become."

A club member, Eustace Thomas, has died at the age of 92. True, he did no flying after the War, but he gained his Silver "C" in 1937 at the age of 69, in a Condor 2 bought from Germany (not a Tern, as stated). His distance flight was from the Long Mynd to the Cotswolds on the day the first British wave flights were made at the Mynd.

* * *

A RADIO-CONTROLLED model glider has stayed in the air for 9 hr. 4 min. in New Zealand, exceeding the official World's record, held by Dr. B. Chase of the United States, by 20 min. The owner, I. Barber, lives at Paraparaumu, on the west coast near the southern tip of North Island: 13 miles to the east of him is Mt. Hector, 5,016 ft. high, at the southern end of the Taiarua Range, which is geologically an extension of the Southern Alps.

The report mentions that the model "was in clouds at an altitude exceeding 1,000 ft." for much of the time, but that is the only clue to the upcurrents it soared in. Its span was 6 ft. and length 4 ft. 9 in.

* * *

DUMFRIES and District Gliding Club has had a year's operation during which a large hangar has been built at the club's permanent site at Townfoot, Thornhill, it was stated at the annual general meeting. This place is 14 miles inland, up the valley of the Nith. During the lambing season they had to migrate temporarily to the Scottish Gliding Union.

An earlier Dumfries and District Gliding Club was formed in 1930, the year when organized gliding began in Britain. Other clubs started in Scotland that year were at Glasgow, Edinburgh, Stirling, Kilmarnock, Falkirk and Dundee. Not till later was the high-sounding Central Scotland Air Yachting Club formed; its air yacht was a primary glider with a crude nacelle.

Dr. A. E. Slater discusses:—

Light on Aviation History

APPROPRIATELY enough, the first lecture to be given in the Royal Aeronautical Society's new lecture theatre was on "Some Problems of Aeronautical History." Yet, curiously enough, practically all the "problems" which lecturer, C. H. Gibbs-Smith, had taken so much trouble in solving were concerned with flights made, or alleged to have been made, when the Society was already in existence, for it was founded in 1866.

The historian, Mr. Gibbs-Smith warned, must be continually on guard against "the bedevilling influence of personal loyalties and prejudices," and especially against eye-witnesses who describe events long after they took place. Both Pearce of New Zealand and Preston Watson of Scotland were each claimed wrongly by a surviving brother to have made a powered flight before the Wrights; while Cody's biographer, G. A. Broomfield, was convinced that Cody first flew on May 16, 1908, forgetting that he had admitted much earlier that he could not give the date when he first saw Cody fly—it was actually Oct. 16. Conceit is another factor to reckon with: Clement Ader never claimed to have got off the ground in 1897 until after he had seen Santos-Dumont do so in 1906.

It is the business of the historian not only to collect facts but to interpret them, and Mr. Gibbs-Smith tried to answer the question: why did Europe take so long to get into the air? He had discovered that Octave Chanute, in giving a lecture in Paris in 1903, not only showed "rows" of photographs of the Wright brothers' activities, but also described just how they used wing-warping in conjunction with the rudder. Yet the French pioneers, "with all these clues in their pockets," went floundering on, never putting any new device through a thorough testing; Blériot, for instance, instead of sticking to the biplane and developing it, which might have brought him success much earlier, appears to have changed over to monoplanes merely because he saw one designed by another inventor.

Failure to make use of research which had already been done was also responsible for lack of progress in the second half of the 19th century, for Sir George Cayley had made a man-carrying glider by 1852 and had laid down the basic principles of a successful flying machine, especially in an "incredibly lucid" article in the *Mechanics' Magazine*, a journal which, Capt. J. L. Pritchard discovered, had a "gigantic circulation" for those times. Yet inventors such as Wenham started again from the beginning instead of going on from where Cayley stopped; otherwise, Mr. Gibbs-Smith believed, Wenham could have built an efficient glider in the 1860's, and we might even have had powered flight by the 1880's.

In the subsequent discussion, Peter Brooks pointed out that Cayley's first model glider had a kite-shaped surface; later he used a rectangular wing, but finally returned to the kite shape for his man-carrying machine. Mr. Gibbs-Smith thought the reason was that Cayley could not work out how to make a reliably safe wing with a bigger aspect ratio. In fact, Peter Masefield felt that structure was the most difficult problem at that time, and that lack of the correct engineering approach in Europe was finally responsible for the Americans beating us to it.

That Free Fall Feeling

HALF a second of weightlessness can be enough to bring on "space sickness," though that is not what Sir Bryan Matthews, F.R.S., called it when he presented a paper to the Royal Society, jointly with Wg. Cdr. T. C. D. Whiteside, on "Tendon Reflexes in Free Fall." At the R.A.F. Institute of Aviation Medicine they had rigged an apparatus in which a seated "subject" is suddenly deprived of his seat and falls 4 ft., taking half a second to do so. The drop was limited to 4 ft., Sir Bryan explained, "so that the subjects could return for more experiments."

On removal of the seat, it was found, the head lags 50 milliseconds behind the hips in starting to fall, so that the spine is temporarily lengthened; likewise, as a photograph showed, the shoulders lag behind the base of the neck and so appear to be lifted. The main reason for these distortions of the body is that, in a normal gravitational field, many muscles are working against gravity to maintain various parts of the body in their normal position; then, when weightlessness suddenly supervenes, it takes a substantial fraction of a second for a sensory impulse to travel up the nerve from the muscle to the spinal cord, and then for a motor impulse to return to the muscle ordering it to relax.

Another finding was that, if the Achilles tendon (just above the heel) is tapped smartly during the 4-ft. drop, the subject feels nothing, and the usual reaction of a sharp extension of the foot is also absent.

The experimenters had thought that the unpleasant effects of suddenly starting to fall were due to the otolith organs in the inner ear; these are the organs which register linear accelerations, in distinction to the semi-circular canals which register angular accelerations. But one subject, whose balancing organs had been put out of action by treatment with streptomycin, reacted just like the others, so the otoliths are not to blame.

The experimenters concluded that the absence of sensation in the tendons was due to the whole central nervous system being flooded with so many messages from all over the body at the onset of weightlessness that a mere tap on a tendon is completely submerged.

These experiments show that investigations into the effects of weightlessness must be divided into two parts: those due to its immediate onset, and those due to its prolongation. Several subjects felt sick, and one actually was sick, as a result of these experiments. So there is some hope that, once the body has recovered from its sudden initial loss of weight, prolonged weightlessness during space voyages can be well tolerated.

Wroundabout

1960 Wroundup: Hoping you will enjoy a splendid New Year, let's look at some of the Old Year's doings:

Names, Numbers and 'Nitials. The same day that this column wondered why Convair followed their 880 with the 600, they gave us best and renumbered it 990. Queer business, this naming by numbers. Remember the embryonic Vickers VC.1000 a few years ago? Now they're building the VC.10. When the Weybridge salesmen are vending it round the World, they might remember a Convair gimmick which I saw in the Sydney office of Qantas' chief executive, Cedric O. Turner. On a table was a large, expensive model of the 990 (*née* 600) finished in Qantas colours, complete with the registration VH-COT. Come to think of it though, the Australians didn't *buy* any, did they?

*

Jolly Party Jokes

"Do you know how my dictionary defines a 'symposium'?"

"No, how does your dictionary define a 'symposium'?"

"My dictionary says a symposium is 'An ancient Greek drinking party with music, dancers or conversation; any drinking party'."

"Ha, ha—no wonder symposiums are so popular."

A group were talking about a plague of ants in the Mess Rooms. Someone asked if they were bright red ants. Flg. Off. S. A. Betts: "No, they're quite unintelligent, actually."

*

"It's a New Year card from IATA —just says 'Happy Landings in 1961'!"

by Wren

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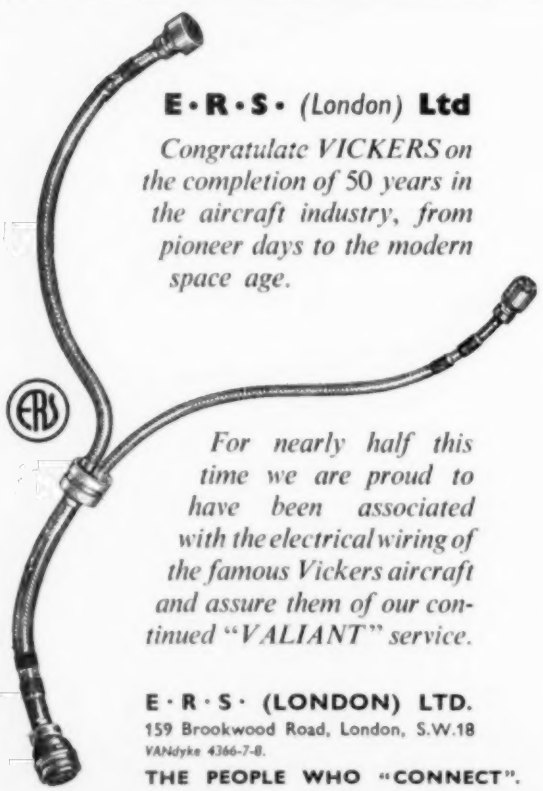

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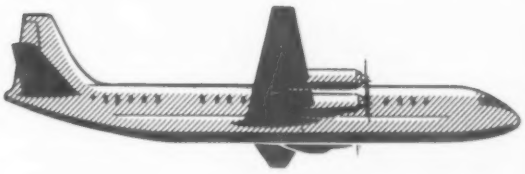

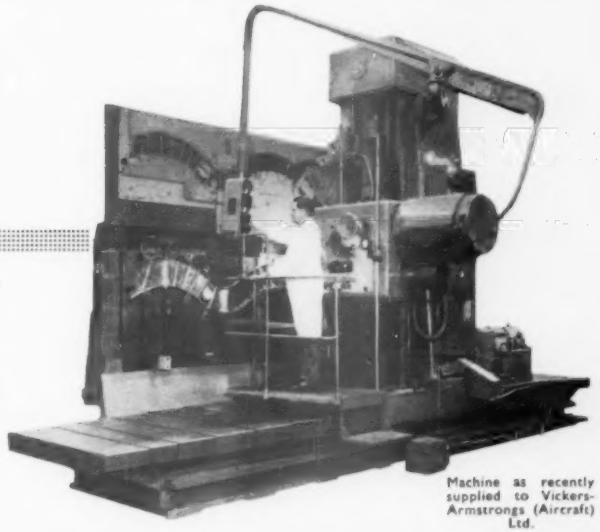

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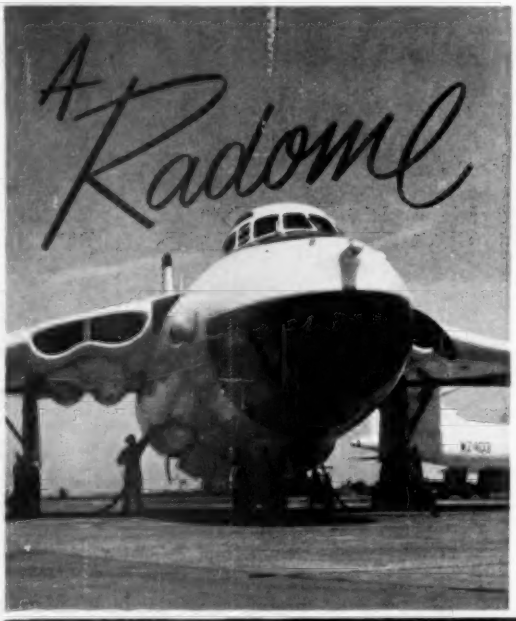

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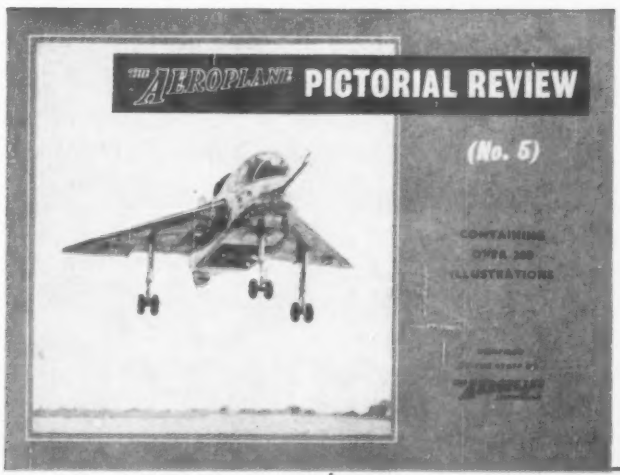

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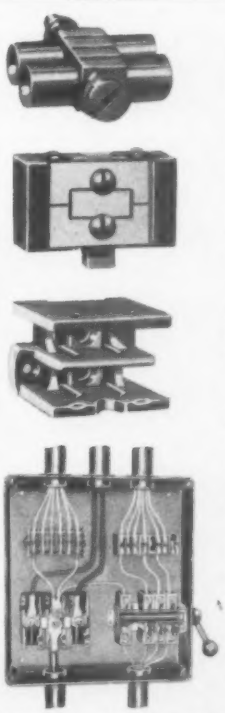

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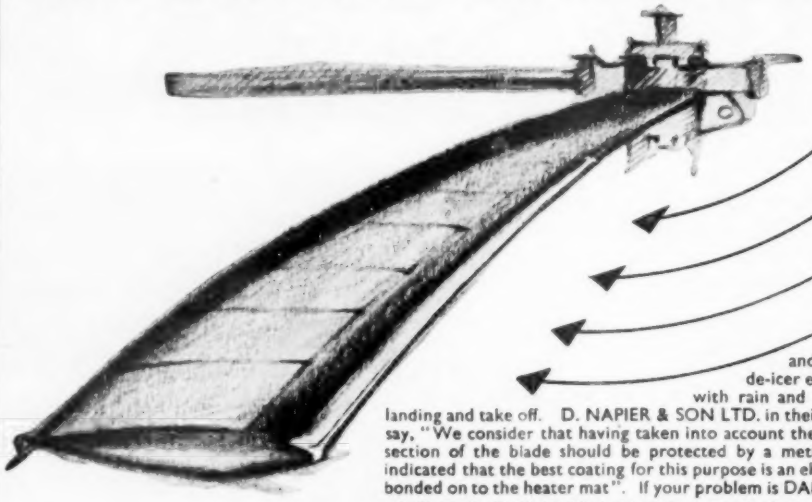

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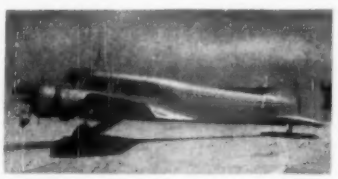

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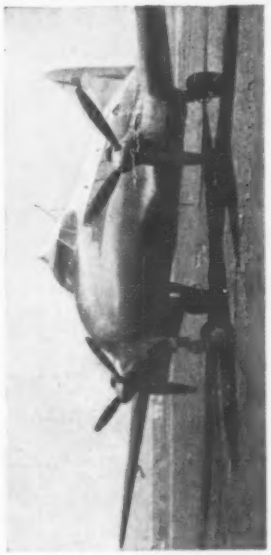

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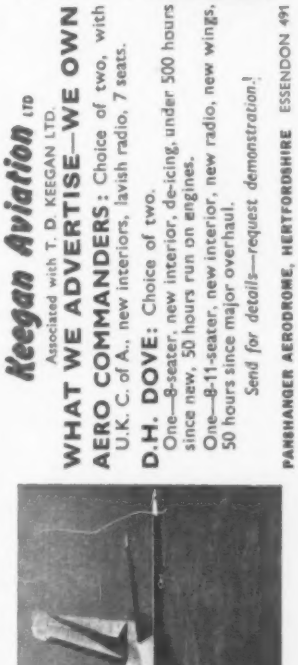

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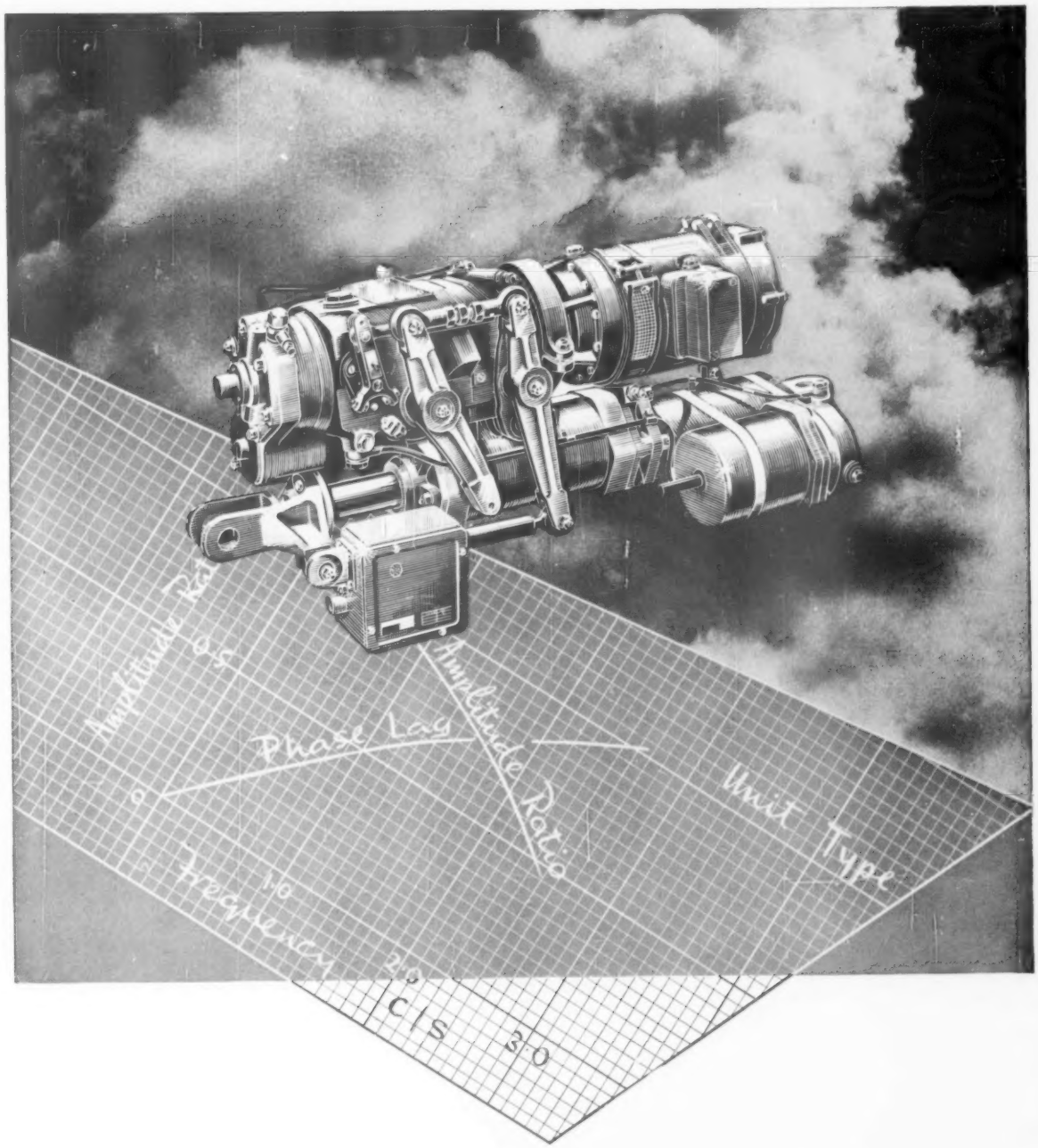

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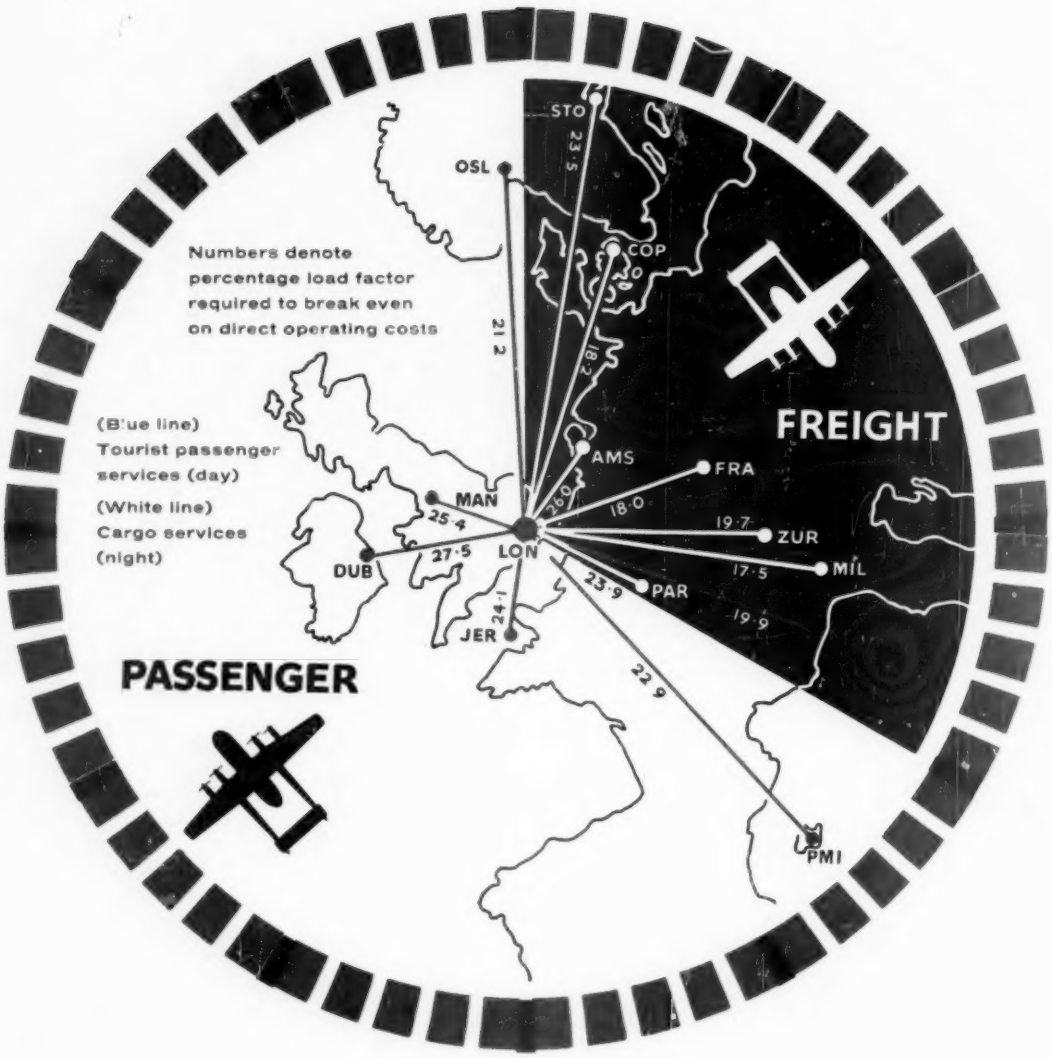

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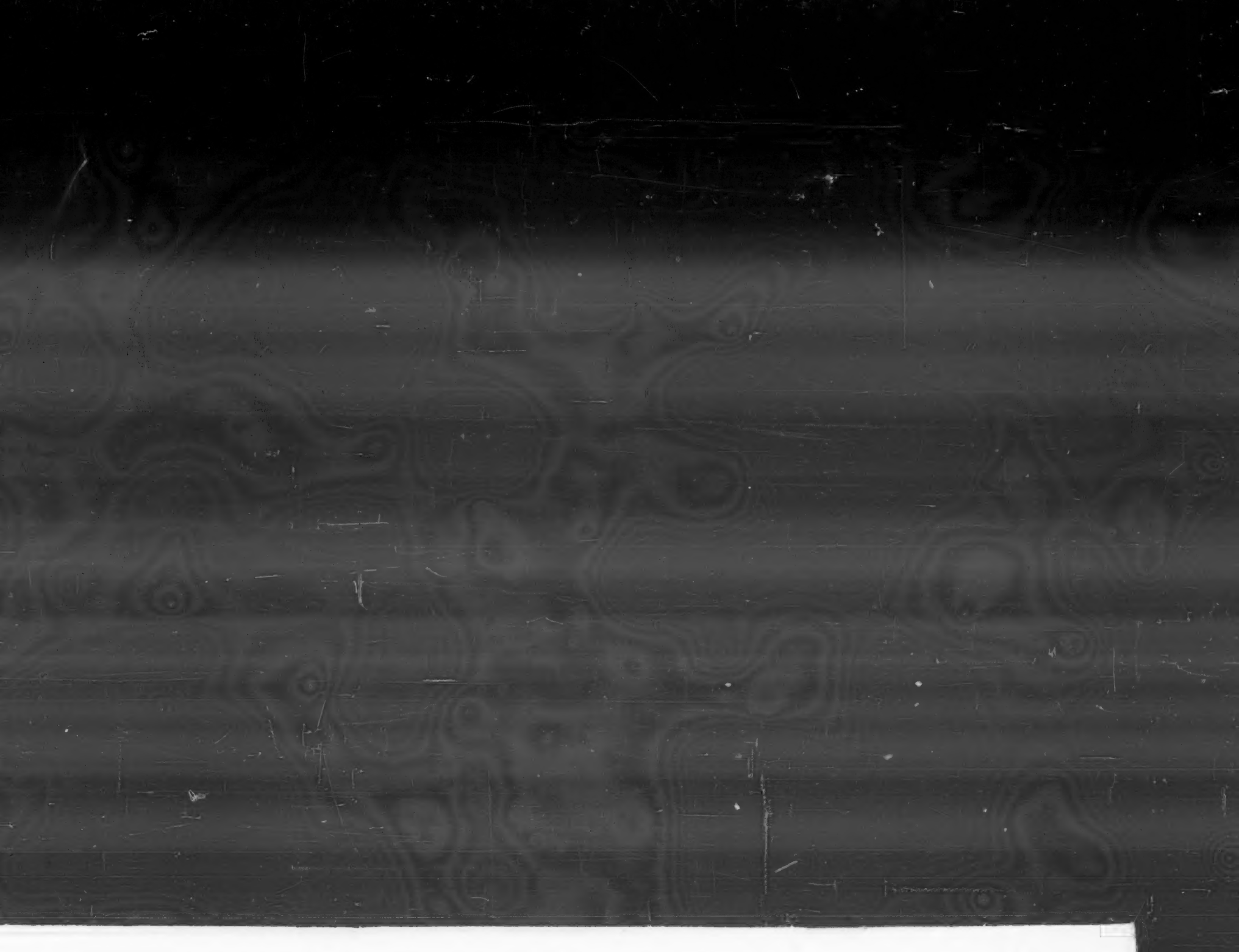
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